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METROLOGY;

OR,

AN EXPOSITION

OF

WEIGHTS AND MEASURES,

CHIEFLY THOSE OF

GREAT BRITAIN AND FRANCE:

COMPRISING

Tables of Comparison,

AND VIEWS OF VARIOUS STANDARDS;

WITH

AN ACCOUNT OF LAWS AND LOCAL CUSTOMS,

Parliamentary Reports, & other important Documents.

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TABLE OF CONTENTS.

PAGE

Exposition of Weights and Measures 1
Standards 3
Invariable Standards from Nature 5
Table of the Length of a Pendulum in different Latitudes 8
Table of the Length of a Degree of the Meridian in different Latitudes 9
On the Figure of the Earth, and the Uniformity of its diurnal Rotation 10
An Account of the Measurement of a Meridian Line in France 12
Comparison between the Metre and the Pendulum 15
Remarks on the Difficulty of measuring the Pendulum 16
An Explanation of the ancient System of Weights and Measures in France 18
An Explanation of the Metrical System, as established in 1795 19
Tables shewing the Proportions between the Weights and Measures of France and England .. 23
Imperial Decree of 1812, allowing the Metrical Standards to be divided in the ancient Manner, and to be called by the ancient Names 27
History of English Weights and Measures 33

PAGE

An Account of the Proceedings and Report of a Committee of the House of Commons, appointed in 1758, to enquire into the State of Weights and Measures 53

Continuation of the History of English Weights and Measures, down to 1816 64

A Synopsis of Laws relating to English Weights and Measures, from the Year 1215 to 1816 67

Standards of English Weights and Measures..... 83

Tables of English Weights and Measures, compared with those of France, with sundry Explanations 84

Weights and Measures of Scotland..... 90

Provincial Weights and Measures of Scotland, alphabetically arranged..... 96

Weights and Measures of Ireland..... 113

A Summary View and Table of the Plan 118

APPENDIX.

Report of the Select Committee of the House of Commons in 1814..... 1

Outlines of the new Bill..... 16

PREFACE.

THE subject of this work, which is at all times interesting to every rank of society, is peculiarly so at the present moment, when an important change is likely to take place in the system of British Weights and Measures. The principles and provisions of the New Bill are here explained, but as, under the circumstances of a change, a knowledge both of the old and new systems becomes equally necessary, a full account is given of the past and present state of the Weights and Measures of the British Empire; and to render the work more extensively useful, those of France are explained, including the ancient system, the decimal or metrical system of 1795, and the *systeme usuel* which was decreed in 1812, and which is now published, it is believed, for the first time in the English language.

New Tables are likewise included, shewing the proportions between those different systems reciprocally, and the English Weights and Measures. An Appendix

is added, containing an explanation of the New Bill, and also the Report of the Select Committee of the House of Commons on the occasion, which must be always a useful and interesting document.

Such are the outlines of a work which has been drawn up with much haste as dispatch seemed essential to its utility. This, it is hoped, may be admitted as an excuse for imperfections, which, from the nature of the subject appear unavoidable even with the greatest care.

FINSBURY SQUARE,
May 1, 1816.

INTRODUCTION.

General View of Weights and Measures.

The importance of the present subject is universally felt and acknowledged. It mingles more or less with every concern, and condition of life. All the productions of land and labour, of nature and art, are bought, sold, or estimated by weights and measures. Hence they have been very properly defined the foundation of justice, the safeguard of property, and the rule of right. Their correctness is among the first precepts of the divine law, and is commanded by every government. Even the laws of honour peculiarly abhor any fraud in this respect, as a base violation of confidence.

The origin of measures is too remote to be traced by any authentic history. They were undoubtedly first pointed out by the size, and the proportions of the human frame; and these natural measures are still used where artificial ones are not at hand: thus the fathom of a well proportioned man is supposed to equal his height, or stature. The pace one-half of his stature. The cubit one-fourth, the foot one-

sixth, and the span one-eighth. The hand is reckoned one-third of the foot, and the breadth of the thumb one-twelfth.*

From these natural measures, it may be fairly concluded that standards of some durable substance were first copied, and as uniformity was a leading principle which all governments endeavoured to establish; standard measures were considered objects of great care. Paucton, who is considered the first authority on this subject, states† that standards were held sacred by the ancients; and deposited in the sanctuary of the Jews, the temples of the Heathens, and the churches of the primitive Christians. He likewise observes, that uniformity of weights and measures was established in Egypt, at a very remote period, and that the

* Other proportions of the human frame are mentioned, which however, are not considered so regular as the above; these are the nail, the arm, the girth, and the head, the latter is paid great attention to by painters and statuaries, who reckon the proportion good when the head is one-sixth or one-seventh of the whole stature. It may not be unworthy of digression to observe, that by a comparison between the ancient and modern foot, the human stature does not seem to diminish as some writers suppose. The English foot with its corresponding system of natural proportions, affords a fine specimen of the human size and figure; it is about a quarter of an inch longer than the ancient Roman foot, and very nearly equal to the Grecian or Olympic foot.

† Metrology de Paucton, page 8.

side of their largest pyramid was made a standard measure, being the 500th part of a degree of the meridian, which had been previously measured; and further, that this agrees very nearly with modern measurements of a degree. He also says that uniformity of measures was strictly observed in many of the neighbouring countries of Asia, and in the different ~~says~~ States of Greece. Among the ancient Romans also there was but one weight and one measure: every town and city throughout their vast empire had a standard which was an exact copy of the archetype kept in the Capitol, and therefore called *Capitolina*.

The Christian Emperors too are said to have followed the example of uniformity, and in the time of Charlemagne it was established in France, but, in succeeding ages, a great diversity was introduced from the abuses of manorial rights and feudal tenures; and from similar causes, a variety of weights and measures prevailed in the states of Italy, Germany, and other countries in Europe.

Whatever the causes may have been, it appears highly probable that uniformity of weights and measures was more generally established and

better observed among the ancients than the moderns. It is indeed remarkable that diversity seems to increase with the extension of commerce, and the progress of arts and civilization.

Some doubt however, may be entertained of this regularity of the ancients, particularly if an account of their laws only, has furnished modern historians with information on the subject. From perusing the laws relating to English Weights and Measures, it might be inferred that great regularity prevailed, which must be the case if those enactments had been duly obeyed. But the state of Scotland is still more extraordinary where every law on the subject enjoined "one weight and one measure" down to the union, and by an article of that treaty it was agreed, that the English system should be adopted; but perhaps no nation in the world exhibits such a variety of weights and measures: and yet it is to be observed, that the inconvenience does not seem at all to interrupt the peace or prosperity of that country.

The diversity of weights and measures that prevails throughout the world, must however, be a great interruption to trade and com-

merce; and numerous plans have been proposed for correcting this evil, by adopting universal standards; but such seem as visionary and impracticable as proposals to establish a universal language.*

Attempts have been made at different periods by the Emperors of Germany, to establish uniformity of weights and measures throughout their empire, but with very little advantage, except in the case of the Cologne Mark, used for the precious metals, which has been very generally adopted; but, which, in less than a century, has become various, by a few grains, in different places. Similar attempts have been made in other countries, with no better success: but the most extraordinary instance of this kind, that has ever occurred in history, is that which has taken place in France. It is well known, that immediately after the revolution in that country, the French academy was ordered by the government to

* On this subject, the following distich of *Budeus* may deserve quotation. De Re Nummaria. L. i. c. 3.

Una fides, pondus, mensura, moneta sit una.
Et status illæsus totius orbis erit.

One faith, one weight, one measure, and one coin,
Would soon the jarring world in friendship join.

tained without the evils of innovation. The advocates for the metre recommend it by observing that should it ever be lost, it might be easily recovered by means of the pendulum, But the toise or any other measure might be adjusted in the same way. Thus they very properly allow the pendulum to be the sovereign regulator for linear measure, as well as for time.

The decimal system is still retained in France, in all large commercial operations; but the binary divisions are found much more easy and practicable in shops or warehouses, and more intelligible to the common people, to whom it should be remembered, the business of weighing and measuring the necessaries of life is almost exclusively committed in every nation.

It seems worthy of remark, that there is, with few exceptions, a similarity in the systems of weights and measures of all countries, which seems to indicate a common origin. Thus the foot, which is the general unit for measures, is duodecimally divided, and the pound, which is the unit for weights, is divided either into 12 or 16 ounces; and in the practice of weighing, the binary division is adopted. In almost every nation, there are two descriptions of weights, one for the precious metals,

and the other for heavy goods, such are the troy and avoirdupois weights in England. The gold pound is generally lighter than that for merchandize, and being more accurately divided and carefully kept, is mostly made the standard, for adjusting other weights.

It may seem an omission here not to be more particular as to English weights and measures, but that subject is fully explained in another place; and the history indeed affords matter for serious reflection both to the moralist and statesman. It will be seen that nearly one hundred laws have been enacted since Magna Charta, without producing the desired effect, To persons unacquainted with the question, nothing can appear more absurd than to continue a system so various in its standards, and so capricious in its divisions; but experience shows that a change can hardly be made without injustice as well as inconvenience; so closely is this subject interwoven with all the regulations of society. History likewise shows that while governments change with great facility their money systems, their constitutions, and even their religion, weights and measures seem immoveable. The French, however, have given a memorable lesson on this subject; but a different example has been held

out by the people of the United States of America, who, though they have made many alterations in their constitution, their laws, and their mint regulations, yet have not changed their ancient system of weights and measures; which, it may be remarked, is the English system with all its anomalies.

On the whole, there appears something very peculiar in the nature of weights and measures. They are so universally mixed, and, as it were, matted with every concern of property, that they cannot be essentially altered without violence and confusion; nor are those evils of a temporary nature. The habits, customs, or prejudices of the multitude are not to be speedily changed. It was computed in France, that in three generations, their metrical system would be fully established; but now it seems to require more. In England, the constant vigilance of the Legislature for five hundred years has been employed in correcting abuses, rather than in improving the system. In short, it appears that nothing has a greater tendency to grow worse, or more obstinately resists improvement, than weights and measures.

EXPOSITION

OF

WEIGHTS AND MEASURES.

In order to explain the principles or theory of weights and measures—measure should be first considered.

Measure, in a commercial sense, signifies the dimensions of any thing bought, sold, valued, or estimated.

Measures are of three sorts, namely; linear, lineal, or long measure; square, or superficial measure; and solid, or cubic measure.

1. Linear Measure is applied to lines, as roads, and distances of all kinds.

2. Square Measure is applied to superficies, having both length and breadth; as land, flooring, &c.

3. Solid Measure determines the contents of bodies that have length, breadth, and thickness or depth; as marble, timber, and vessels; which latter are also called measures of capacity.

Linear Measure, is the element of all other measures, and likewise of weights. It is ob-

tained by the comparison of some known measure which is acknowledged as a standard or just pattern of length.

Square Measure, is determined by multiplying length and breadth together; and

Solid Measure, by multiplying length, breadth, and depth together.

WEIGHT, may be defined a natural property of matter, proportioned to its bulk and the density of its parts. It is determined by being balanced in a scale against some known or acknowledged weight placed in the opposite scale.

A standard for length being once determined, a standard for weight is thence easily deduced: as a vessel of any certain dimensions filled with distilled water, or other homogeneous liquid, will always weigh the same in the same latitude.*

STANDARDS.

Standards, in a commercial sense, signify any measure or weight of acknowledged authority, by which others of the same denomination are

* Water has been objected to on account of the difficulty of ascertaining when a vessel is exactly full. A standard weight, however, can be obtained very accurately by the aid of water, by a method lately proposed by Mr. Troughton. Thus, if a metallic cylindrical vessel of any certain dimensions be made so light, as when immersed in pure water of a certain temperature it will neither sink nor swim, then such a body will weigh its dimensions of water, and will serve as an accurate and practical standard.

to be sized, compared, or adjusted. They are distinguished into arbitrary standards, and invariable standards from nature; the former are those universally adopted (except in France), and the latter are intended to correct them, or restore them, if lost.

The standards of all nations seem uncertain, and even accidental, in their origin. Those of linear measure appear, from their names, to have been taken from some part of the human frame, as the foot, the hand, the span, the nail, the cubit or elbow, the *ulna*, aune or arm, the fathom, the pace, &c. The inch, in some places, is determined by barley-corns; but in others it is called the thumb.* The finger too has been used as $\frac{2}{3}$ of an inch.

As such vague measures must vary with the different sizes of men, it became necessary that each community or government should agree upon making standards of some durable substance; and such were often taken from the foot or arm of some distinguished person; as the ancient Saxon *gyrd* or girth (the modern yard) is said to have been adjusted by the arm

* The foot is the most general unit for measures, as the pound is for weights; and it is remarkable that both have been divided into the same number of equal parts, and that their divisions were anciently called by the same name, *uncia*, which means a twelfth part of the whole. Hence the inch was called the *uncia pedis*, and the ounce the *uncia libræ*.

of Henry the First. Probably for a similar reason, the old French foot has been called the *pied de roi*.

From such patterns, a great diversity of standards must naturally follow, and this variety has had a constant tendency to increase, from the decay and waste of all material substances, as well as from the unskilfulness of artisans and other causes.

With a view to remedy those evils, different plans have been proposed for establishing standards from nature, which would be unalterable by time or place, and to which all nations might conform; but such conformity cannot be expected, nor is it practicable, as the gravity of bodies varies in different parts of the World, on account of the spheroidical figure of the earth. Invariable standards, however, may be rendered highly useful for correcting standards already established, or forming new systems of weights and measures.

INVARIABLE STANDARDS FROM NATURE.

If arbitrary standards, however uncertain or capricious in their origin, could be always preserved uniform, they would answer all the useful purposes for which they are intended. But as the hardest substances are liable to decay, methods have been devised for obtaining stand-

ards from some invariable property of nature: such as the law of gravitation, the motions of the heavenly bodies, or the measure of the earth, that is, of some arc or portion of a meridian circle. And it is remarkable, that, in deducing standards from nature, nature opposes many obstacles, hard to be surmounted.

Of the various methods that have been proposed, two only have been acted upon with any degree of success; * namely,

1. The length of a pendulum, that vibrates seconds of mean time.

* Among the other methods which have been suggested for obtaining an invariable standard from nature is, the space that a heavy body would fall through in a second of time, which, in the latitude of London, is $16\frac{11}{12}$ feet, but of course, like the other standards, it must vary in different latitudes, and it is moreover affected by the resistance of the atmos This operation, which has been found extremely difficult, has been of late years rendered more practicable, by means of an apparatus invented by Mr. Atwood.

A very curious mode of measuring the length of a pendulum which has been demonstrated by Huygens, is by means of a rectangular cone. Thus, when suspended by its vertex, and made to vibrate, the centre of its base is the centre of oscillation; and, reciprocally, when suspended by the centre of its base, its vertex is the centre of oscillation. The length of the isochronous simple pendulum being in both cases equal to the altitude of the cone, or the semi-diameter of its base. See Dr. Hutton's *Mathematical Dictionary*, new edition, under different articles.

2. The length of an arc, or portion of the meridian.

If the earth had been a perfect sphere, these measures would be respectively the same on all parts of its surface: but its figure is a kind of oblate spheroid; having its equatorial diameter longer than its axis or polar diameter.*

From this cause the gravity at the poles is greatest, being nearest to the centre of the earth; and it gradually diminishes to the equator. Hence a pendulum will vibrate quickest at the poles, and slowest on the equator; and therefore, in order to measure or designate any equal portions of time, it must be gradually lengthened from the equator to the poles.

From the spheroidical figure of the earth too, the degrees of the meridian vary, increasing like the pendulum from the equator to the pole.

In order to ascertain those variations and proportions, many calculations and measurements have been made by the greatest mathematicians; and yet, with all their accumulated labours up to the present time, several important inquiries as to the figure of the earth, still remain without satisfactory solutions.†

* The centrifugal motion of the earth too has also some effect on the weight of bodies on its surface.

† It appears, says Laplace, that the earth differs sensibly from an ellipsoid: there is reason also to believe that it is not a solid of revolution, and that its two hemispheres are not equal on each side of the equator, *Système du Monde, Vol. I. p.* 121.

According to Sir Isaac Newton's computation, the equatorial diameter of the earth is to the polar diameter, as 230 is to 229; or, in other words, the earth's ellipticity is $\frac{1}{230}$; but from actual measurement, as well as from the theories of modern astronomers, the ellipticity is found to be about $\frac{1}{334}$: which is the latest determination given by the Count Laplace.*

The following tables exhibit an interesting view of the labours of many great mathematicians in order to determine the figure of the earth, and thence to compute invariable standards for linear measurement.

* From the theory and formulæ given in the Mechanique Celeste, the following computation has been made of the length of a pendulum to every 10 degrees of latitude, supposing it to be 1 on the equator.

Lat.	
0°	1,0000000
10°	1,0001716
20°	1,0006657
30°	1,0014227
40°	1,0023513
50°	1,0033395
60°	1,0042681
70°	1,0050251
80°	1,0055192
90°	1,0056908

Length of a Pendulum vibrating Seconds in different Latitudes.

Countries.	Latitude.	Length of Pendulum.	Measurers.
	° ′	Inches.	
Under	0. 0	38, 973	Bouguer.
the	0, 0	38, 969	Bouguer.
Equator	0. 0	38, 994	Bouguer.
Porto Bello	9. 34	39, 003	Bouguer.
Madras	13. 4	39, 026	Sir J. Warren.
St. Domingo	18. 27	39, 017	Bouguer.
Cape of G. H.	33. 55 S	39, 083	Bouguer.
Geneva	46. 12	39, 092	Mallet.
Paris	48. 50	39, 119	Bouguer.
Paris	48. 50	39, 123	Mairan.
Paris	48. 50	39, 134	Borda.
London	51. 32	39, 121	Emerson.
London	51. 32	39, 128	Desaguillieres.
London	51. 32	39, 130	Graham.
London	51. 32	39, 119	Whitehurst.
London	51. 32	39, 136	Dr. Rotherham in a Cycloid.
London	51. 32	39, 200	Sir Jonas Moore.
Leyden	52. 9	39, 140	Luloffs.
Petersburgh	59. 56	39, 163	Mallet.
Pellau	66. 48	39, 181	Maupertuis.
Lapland	67. 4	39, 181	Mallet.

Length of a Degree of the Meridian in different Latitudes.

Countries.	Mean Latitude.	Length. Miles.	Measurers.	Date.
Peru	°. ′ 0. 0	68, 751	Juan.	1744
Peru	0. 0	68, 732	Bouguer.	1744
Peru	0. 0	68, 713	Condamine.	1744
India	12. 32	68, 743	Lambton.	1803
Cape of G. H.	33. 18 S	69, 076	La Caille.	1752
America	39. 12	68, 895	Mason & Dixon.	1768
Italy	43. 0	68, 998	Boscovich.	1755
Italy	44. 44	69, 061	Beccaria.	1764
France	44. 52	68, 769	Biot & Arago.	1808
France	45. 0	69, 092	La Caille.	1740
France	46. 12	69, 052	Delambre & M.	1793
Germany	47. 40	69, 142	Leisganig.	1766
France	49. 20	68, 763	Fernel.	1525
France	49. 22	68, 945	Picard.	1669
France	49. 22	69, 119	Cassini.	1718
France	49. 22	69, 121	Cassini.	1740
France	49. 23	69, 114	Academy.	1744
England	51. 30	69, 146	Mudge.	1802
England	52. 2	69, 133	Mudge.	1802
Holland	52. 4	66, 91	Snell.	1620
Lapland	66. 20	69, 403	Maupertuis.	1737
Lapland	66. 20	69, 292	Swanberg.	1803

The measurements contained in the foregoing tables give curious results, with respect to weights and measures on different parts of the globe. From those tables it has been computed, that 100lb. on the equator, will weigh in the latitude of London, 101,90lb. and at the pole, 103,15lb. Also, that 100 acres at the equator, would equal 101,34, in the latitude of London, and 102,57, at the Pole.

It is indeed curious to observe that notwithstanding the irregularity of the earth's surface, and the inequality of its annual motion round the sun, its diurnal rotation on its axis is perfectly uniform;* and it is from the perfect

* Some philosophers have doubted of the perfect equability of the earth's diurnal rotation on its axis; but from the best observations that have been made for 2000 years, in fixed observatories, it is concluded that there is no variation whatever. It is perhaps the only uniform motion of which astronomers are certain. And here it may be worthy of remark, that no natural cause has yet been assigned for the diurnal rotation of the planets. Sir Isaac Newton observes, in one of his letters to Dr. Bentley, (reviewed in Dr. Johnson's Works, Vol. II. p. 332, Murphy's edition) that "the diurnal rotations of the planets cannot be derived from gravity, but must require a divine arm to impress them."

The above question respecting the natural cause of planetary rotation was submitted to the principal Astronomers of France in the summer of 1814, at a Meeting of their Board of Longitude. It was introduced by a visitor from England, who wished to learn if any new light had been thrown on the subject, by the great advances made in analytical science and physical

measure of time which it affords, that the use of the pendulum is deduced as a standard; but it must be also assumed that gravitation is uniform, the earth being of equal density, so as to attract in proportion to the distance from the centre.

Philosophers have been very much divided in opinion as to the comparative merits of the pendulum and the measure of the meridian, that is, which of those two methods can afford the best standard measure. Before any comparison is here made, it may be proper to explain the French metrical system, which may tend to elucidate the question.

NEW SYSTEM OF WEIGHTS AND MEASURES ESTABLISHED IN FRANCE, 1795.

The outline of the new metrical system established in France, is thus set forth by the *Count Laplace*, in his *Système du Monde*.

"We cannot reflect on the prodigious number of measures in use, not only among different

astronomy, by some of the members present. They all agreed that no satisfactory solution had yet been given of the phenomenon; and they listened with much attention to the opinion quoted from Sir Isaac Newton's Letters, which they had not previously known, and on which the Count Laplace modestly observed—"SI NEWTON N'A PAS PU L'EXPLIQUER CE N'EST PAS A NOUS D'Y PRETENDRE."

nations, but even in the same country, their capricious and inconvenient divisions, the difficulty of determining and comparing them, the embarrassment and the frauds which they occasion in commerce, without regarding, as one of the greatest benefits, that the improvements of the sciences and the ordinances of civil governments can render to mankind the adoption of a system of measures, of which the divisions, being uniform, may be easily employed in calculations, and which may be derived, in a manner the least arbitrary, from a fundamental magnitude indicated by nature itself. A nation that would introduce such a system of measures, would unite to the advantage of reaping the first fruits of the improvement, the pleasure of seeing its example followed by other countries of which it would thus become the benefactor: for the slow but irresistible empire of reason must at length prevail over national jealousies, and over all other obstacles that are opposed to a measure of which the convenience is universally felt. Such were the motives that determined the Constituent Assembly to entrust the Academy of Sciences with this important charge. The new system of weights and measures is the result of the labours of the committee seconded by the zeal and information of several members of the national representation.

" The decimal division was adopted without

hesitation; and in order to preserve the uniformity of the whole system, it was resolved to deduce every thing from one and the same linear measure and its decimal divisions. The question was then reduced to the choice of this universal measure, to which the name of *metre* was to be given.

" The length of the pendulum, and that of a meridian of the earth, are the two principal standards that nature affords us for fixing the unit of linear measure; both of these being independent of moral revolutions, they cannot experience a sensible alteration without very great changes in the physical constitution of the earth. The first method, which is of easy execution, has the inconvenience of making the measure of length depend on two elements, heterogeneous with respect to that measure and to each other, gravitation and time: besides that the divisions of time into small portions is wholly arbitrary. It was resolved therefore to employ the second method, which appears to be of very high antiquity; so natural is it to man to refer measures of distance to the dimensions of the globe which he inhabits."

" The arc which was measured in 1740, from Dunkirk to the Pyrenees, might have served for finding the magnitude of the quadrant of the meridian: but a new and more accurate measurement of a larger arc was more likely to ex-

cite an interest in favour of the new measures. Delambre and Mechain were therefore entrusted with the direction of the operations for measuring an arc from Dunkirk to Barcelona; and after making a proper correction for the ellipticity of the earth, a quadrant was determined, and the ten millionth part of it was taken for the unit or *metre* as the standard of linear measure; and in order to be able always to identify its length without recurring to an actual measurement of the arc, it was of importance to compare it very accurately with the length of the pendulum vibrating seconds; and this has been done with great care by Borda, at the observatory at Paris." *So far Laplace.*

Such are the views given of the plans and proceedings of the French Academy, in fixing a standard. It remains, therefore, to state their further proceedings; but before this is done, some remarks on the comparative excellence of the metre and pendulum, may not be unseasonable.

THE METRE AND PENDULUM COMPARED.

The reasons for preferring the metre to the pendulum, given in the foregoing paper, agree with those stated by Brisson, Tarbé, and other authors on the metrical system of weights and measures; on which it be may be observed, that

the mode adopted by the ancients to obtain a standard measure from the earth, was of necessity, as the pendulum was not then known. As to its depending on two elements heterogeneous to each other, that is of no consequence, if each be uniform in itself, which uniformity cannot be doubted. But all those learned authors make one acknowledgment, which indeed settles the question of superiority.

They mention, as a recommendation of the metre, that should it ever be lost, it may be easily recovered by means of the pendulum. Thus they allow the latter to be in reality the true standard and ultimate criterion.

It must, however, be owned, that the accurate measurement of the pendulum, is a problem of peculiar difficulty. The obstacles, both natural and mechanical, that occur, are such as to render it doubtful whether the exact length from the point of suspension to the centre of oscillation has been ever ascertained.*

The length of the pendulum, however, has been determined with sufficient correctness to answer every useful purpose of a standard for linear measure: even were it taken at $39\frac{1}{8}$ inches it would be sufficiently accurate in any part of

* For a full and accurate account of the principles and varieties of the pendulum, see Dr. Rees's New Cyclopedia; under the head *Pendulum*, which article is ascribed to the Rev. Dr. Pearson.

England or France for practical utility. Still, however, it is most desirable that every property of this noble instrument should be perfectly known.

In comparing the results of the most esteemed measurers of the pendulum given in page 8, it will be seen that there are anomalies which cannot be reconciled. Thus the lengths given by Graham and Borda differ the wrong way for their latitudes; were those results reversed, the difference would very nearly accord with the theory of La Place. (See note, p. 7.)

Among the measurements of the pendulum made in England, that of Mr. Graham is the most approved; but it is to be observed, that since his time great advances have been made in the mechanical arts. He had no means, for instance, of comparing measures nearer than ,005 of an inch; but by the microscopic beam compass, invented by Mr. Troughton, the result can be obtained within ,0001 of an inch, that is, with 50 times the accuracy of the old apparatus.

Much, therefore, may be expected from a new measurement of the pendulum recently ordered by the Royal Society of London.*

* The Members selected for this interesting operation are Dr. Young, Dr. Wollaston, and Mr. Troughton, and the selection augurs well for the success of the undertaking.

It is understood that they are to pursue their own respective plans independently of each other.

EXPLANATION OF THE FRENCH METRICAL SYSTEM.

The fundamental standard adopted in France for the new system of weights and measures, is, as before stated, a quadrant of the meridian; that is to say, the distance from the equator to the north pole. This quadrant is divided into ten millions of equal parts, and one of these parts or divisions is called the *metre*, which is adopted as the unit of length, and from which by decimal multiplication and division all other measures are derived. The length of the quadrant has been computed by measuring an arc of the meridian, between the parallels of Dunkirk and Barcelona, and it has been found to measure 5130740 French toises, which, divided by 10 millions, gives 36. 9413 French inches, which is the METRE, or element of all the other measures, and which is equal to 39. 371 English inches.

In order to express the decimal proportions the following vocabulary has been adopted.

The word, *Deca* prefixed means 10 times.
Hecto - - - - - - 100 times.
Kilo - - - - - - - 1000 times.
Myria - - - - 10, 000 times

On the contrary, for divisors,
the word *Deci* expresses the 10th part.
Centi - - - - 100th part, and
Milli - - - - 1000th part.

Thus *Deca-mètre* means 10 metres.

Deci-mètre the 10th part of a metre.

Hecto-mètre 100 metres.

Centi-metre the 100th part of a metre, and so on for the rest.

The *mètre* (as before stated) is the element of long measure.

The *are*, which is a square *deca-mètre* (or 100 square metres) is the element of superficial measures.

The *stere*, which is a cubic *mètre*, is the element of solid measures.

The *litre*, which is the cubic *deci-mètre*, is the element of all liquid measures, and of all other measures of capacity.

Lastly the *gramme*, which is the weight of a cubic *centi-mètre* of distilled water, is the element of all weights.

In the following tables are given the proportions between the new weights and measures of France and the old, and also their relations to English weights and measures.

But in order to understand those tables, it will be necessary to learn the following outlines of the old system.

OLD WEIGHTS AND MEASURES OF FRANCE.

LONG MEASURE. The toise, or fathom of France, equals 6 feet, (pied de Roi); the foot 12 inches, (pouce); and the inch 12 lines, each subdivided into 12 points; 76 French feet are nearly equal to 81 English feet; or more accurately, 40,000 French feet, inches, or lines, equal 42,638 English feet, inches, or lines. Thus 1 French foot equals 1.06597 English, or 12,78934 English inches; and hence one English foot equals 11,26 French inches. The Paris aune was $46\frac{1}{2}\frac{7}{0}$ English inches.

The *old French road measure*, is still retained; the *lieue*, or league, is 2 French miles, each mile 1000 toises; hence the French league equals 2 English miles, 3 furlongs, and 15 poles.

The French league, however, in different parts of France, has been applied to different distances. The marine league, (20 to a degree,) equals 2853 toises, or 6081 English yards; and the astronomical league, (25 to a degree) equals $2282\frac{2}{7}$ French toises, or 1865 English yards.

The *arpent*, or acre of land, contained in general 100 square perches, but the perch was various in different provinces.

The old French weight for gold and silver, (called *poids de marc*,) makes the pound, or livre, contain 2 marcs, 16 onces, 128 gros, 384 deniers, or 9216 grains.

The French marc =3780 grains, troy weight.

For *commercial weight*, the poids de marc was likewise used; and the *quintal* of 100 livres= 108lb. avoirdupois, very nearly.

Commercial weight, however, as well as measures of capacity, varied considerably in the different provinces.

Corn measure was the muid of 12 setiers, 24 mines, 48 minots, or 144 bushels.

Wine measure was the muid of 36 setiers, 144 quartes, or 288 pintes.

COMPARISON OF FRENCH AND ENGLISH WEIGHTS AND MEASURES.

It may help to illustrate the following Tables to observe the standard units printed in *italics* with their values, &c.

English.

Thus the metre =3,2809167 ft. or 39,371 inches
Are =1076,441 square feet
Litre =61,028 cubic inches
Stere =35,317 cubic feet
Gramme=15,4441 grains troy
The Gramme also=5,6481 drams avoirdupois,

from which the kilogramme and its divisions are easily computed (see page 31); and also the quintal metrique, the common commercial weight, which equals 1cwt. 3qrs. 24lb. avoirdupois. All other proportions between the two systems may be thus easily computed.

New Weights and Measures of France compared with the old, and also with English Weights and Measures.

LINEAR MEASURE.

	French Feet.	English Feet.
Distance from the Equator to the Pole	30784440	32809167
Degree (centesimal)	307844,4	328091,67
Myriametre	30784,44	32809,167
Kilometre	3078,444	3280,9167
Hectometre	307,8444	328,09167
Decametre	30,78444	32,809167
Metre	3,078444	3,2809167

	Lines.	Lines.
Decimetre	44,3296	47,2452
Centimetre	4,43296	4,72452
Millimetre	0,443296	,472452

SQUARE OR SUPERFICIAL MEASURE.

	French Square Feet.	English Square Feet.
Myriare	9476817,46113	10764414,3923
Kilare	947681,746113	1076441,43923
Hectare	94768,1746113	10764,143923
Decare	9476,81746113	1076,4143923
Are	947,681746113	107,64143923
Deciare	94,7681746113	10,764143923
Centiare Metre carré	9,47681746113	1,07644143923

	Square Inches.	Square Inches.
Square Decimetre	13.646617	15.500756

	Square Lines.	Square Lines.
Square Centimetre	19,651134	22,321088
Square Millimetre	0,19651134	0,2232103

MEASURES OF CAPACITY.

	French Cubic Feet.	English Cubic Feet.
Myrialitre	291, 738519	353, 1714693
Kilolitre, Metre Cube	29, 1738519	35, 31714693
Hectolitre	2, 91738519	3, 531714693
	Cubic Inches.	Cubic Inches.
Decalitre	504, 124160	610, 280, 264
Litre ou Decimetre cube	50, 4124160	61, 0280264
Decilitre	5, 04124160	6, 10280264
	Cubic Lines.	Cubic Lines.
Centilitre	871, 126926	1054, 564296

The *Litre*, which is the unit for measures of capacity = 2,113 English pints, wine measure; and therefore the *Hectolitre* equals 26,4 such gallons—35 litres = a Winchester bushel.

SOLID OR CUBIC MEASURES.

	French Cubic Feet.	English Cubic Feet.
Decastere	291, 738519	353, 1700
Stere (metre cube)	29, 1738519	35, 3170
Decistere	2, 91738519	3, 5317

This measure is used for fire-wood, stone, &c. The *stere* is the same as the *kilometre* in the preceding measure.

WEIGHTS.

	Poids de Marc. livres. on. Gros Grains	Eng. Troy Weight. lb. oz. dwt. grs.
Bar or Cubic Metre of Water	2042. 14. 0. 14 ..	2681. 3. 6. 2,
Myriagramme ..	20. 6. 6. 63, 5 ..	26. 9. 15. 1, 46
Kilogramme.....	2. 0. 5. 35, 15 ..	2. 8. 3. 12, 146
Hectogramme	3. 2. 10, 715 ..	3. 4. 8, 414
Decagramme	2. 44, 2715 ..	6. 10, 441
Gramme	18, 82715 ..	15, 4441
Decigramme	1, 882715 ..	1, 54441
Centigramme.....	0, 1882715 ..	0, 15444

FRENCH NEW MEASURE OF TIME COMPARED WITH THE OLD OR USUAL SYSTEM.

New Division.		Old Value. H. M. S.
	1 second	0 0 0,864.
100 seconds	1 minute	0 1 26,4.
100 minutes	1 hour	2 24 0.
10 hours	1 day	24 0 0.

REVERSED.

Old or usual Division.		New Value. H. M. S.
	1 second	0 0 1,1574.
60 seconds	1 minute	0 69 54,4.
60 minutes.....	1 hour	1 15 74.
24 hours	1 day	10 0 0.

FRENCH NEW MEASURE OF THE CIRCLE COMPARED WITH THE OLD OR COMMON SYSTEM.

New Division.		Old Value.
100 seconds	1 minute of space ..	$0^{\circ}\ 0'\ 32''\frac{2}{5}$
100 minutes	1 degree	0 54 0
100 degrees	1 quadrant	90 0 0
400 degrees	1 circle	360 0 0

REVERSED.

Old Division.		New Value.
60 tierces	1 second	$0^{\circ}\ 0'\ 3''\frac{7}{81}$
60 seconds	1 minute of space ..	$0\ 1\ 85\frac{5}{27}$
60 minutes	1 degree	$1\ 11\ 11\frac{1}{9}$
90 degrees	1 quadrant	100 0 0
4 quadrants or 360°	1 circle	400 0 0

Although the divisions of the circle, as well as the decimal divisions of time, have been discontinued in France, yet their explanation may be useful, as several scientific works of great merit were published in that country during the period of their adoption.

A VIEW OF THE PRESENT STATE OF WEIGHTS AND MEASURES IN FRANCE.

The success of the new system of weights and measures, introduced in France, is a subject of very important inquiry. It is interesting to know how a learned and beautiful theory has succeeded in practice; what inconveniences have been

experienced; and what advantages have followed? In order to obtain this information from the best authority, the author of the present work, lately wrote to a French merchant of considerable experience in the affairs of trade and commerce, and possessing also a very accurate knowledge of the provincial traffic and local customs of France. The following is a literal translation of his answer.

"The introduction of the new system of weights and measures into France, has experienced, as might be expected, the greatest and most general opposition. There were two enemies to be contended with, hard indeed to be conquered: first, habit, which particularly with the common people is second nature, and which has made them always distrust the use that the merchants might make of these new weights and measures to their detriment; and they were the more suspicious, as all the new Greek denominations were foreign to their ears. It was found too late, that it was wrong not to preserve, at least for some time, or perhaps for ever, the old denominations, applying them to the new measures. There was an endeavour made afterwards to remedy it, by an attempt of conciliation, which I shall mention presently, which has not had all the good effect that was expected, but on the contrary has produced new inconveniences.

Secondly, private interest, that wilful blindness whose eyes it is so hard to open. The generality of shopkeepers thought erroneously, that their profits depended exclusively on the study that they had made of the relations between the weights and measures of the country of production, with those of the places of consumption. They thought their trade would be destroyed, when the consumer could easily calculate the prime cost of the goods; and from that time they used their utmost exertions to oppose the admission of this new system.

" These various oppositions, however, began to give way, and it is certain that they would have been at last entirely surmounted, if the government had persisted in refusing any concession.

" Such was the state of things when the Imperial government, about the year 1812, with a view to join the respect due to old habits, with the preservation of the new system, allowed, for a limited time, that, instead of different fractions of the new weights and measures, others called *usuelle* should be formed, bringing them as nearly as possible to the value of those anciently in use; thus for example a half kilogramme forms at present a new measure called the *livre usuelle;* it is not exactly the old livre, *poids de marc*, but nearly 3 gros grains more.

"Thus then the new system is still preserved, since this new weight is exactly half of the kilogramme; but by a concession, much to be regretted, it has been permitted to divide this half kilogramme, not by decimals, but, like the old livre, into 16 ounces, and the other divisions as in the ancient poids de marc. In a word, this new ounce and its divisions depart so widely from the *gramme*, that the proportion cannot be discovered without the aid of calculation. Similar concessions have been made with respect to the divisions of measures of extent and capacity, and to these changes people very naturally bend, because they come near their old habits; but they remove them farther from the new decimal system, which it is still intended to preserve, and to establish in the end."

To the above Letter is here added a translation of the decrees of 1812, with a table explaining the application.

Extract of a Decree of the 12th February 1812, concerning Weights and Measures.

ART. I. No change shall be made in the units of the weights and measures of the empire, such as they were fixed by the law of 1800.

II. Our minister of the interior shall cause

to be constructed for the use of commerce, instruments of weighing and measuring, that will give either the fractions or the multiples of the said units, which are the most general in commerce, and adapted to the wants of the people.

III. These instruments shall bear on their different fronts the comparison of the divisions and denominations established by the laws, with those anciently in use.

IV. We reserve ourselves to give an account, after a delay of ten years, of the results that experience shall have furnished as to the improvements which the system of weights and measures would be susceptible of receiving.

V. In the mean time the legal system shall alone continue to be taught in all the schools of our empire, including the primary schools, and to be alone employed in all public administrations, and also in the markets, and in all commercial and other transactions between our subjects.

Extract of the Resolution passed by the Minister of the Interior, 28th March 1812, *for the execution of the foregoing Decree.*

Art. I. It is permitted to employ for the use of commerce,

1. A measure of length equal to 2 *mètres*,

which shall be called *toise*, and be divided into 6 feet.

2. A measure equal to $\frac{1}{3}$ of the metre, or $\frac{1}{6}$ of the toise, which shall be called foot *(pied)*, shall be divided into 12 inches *(pouce)*, and the inch into 12 lines.

II. Each of these measures shall bear on one side the corresponding divisions of the metre, that is, the toise, 2 metres divided into decimetres, and the first decimetre into millimetres, and the foot $3\frac{1}{3}$ decimetres divided into centimetres and millimetres; in all $333\frac{1}{3}$ millimetres.

III. The measurement of linens and stuffs may be made with a measure equal to 12 decimetres, and shall be called *aune*. This measure shall be divided into halves, quarters, eighths, and sixteenths, as well as into thirds, sixths, and twelfths. It shall bear on one side the corresponding divisions of the metre in centimetres only; viz. 120 centimetres numbered in tens.

IV. Corn and other dry goods may be measured retail with a measure equal to $\frac{1}{8}$ of the hectolitre, which shall be called *boisseau*, and shall have its double, halves, and quarters.

V. Each of these measures shall be marked with its name, and also the indication of its proportion with the hectolitre.

VI. For the retail sale of corn, small shot, meal, dry or green vegetables, the litre may be divided into halves, quarters, and eighths.

VII. For the retail sale of wine, brandy, and other liquors, measures of the quarter, eighth, and sixteenth of a litre may be employed. Each of the said measures shall be marked with its name, indicative of its proportion with the litre.

VIII. For the retail sale of all substances, whose price and quantity are regulated by weight, the merchants may employ the following *poids usuels;* viz.

The *Livre* equal to the half kilogramme or 500 grammes, which shall be divided into 16 onces;

The *once* the 16th of the livre, which shall be divided into 8 gros;

The *gros* the 8th of the once, which shall be divided into 72 grains.

Each of these weights shall be likewise divided into halves, quarters, and eighths. They shall bear, besides their own name, the indication of their value in grammes."

The divisions ordained in the foregoing decree are stated in the following table, with their proportions to the metre, and also to English weights and measures.

COMPARISON OF WEIGHT.

Poids usuels.	Grammes.	Troy Weight. Dwt.	Gr.	Avoirdupois. Oz.	Dr.
Livre usuelle	500	32	3,98	17.	10,4
Half	250	16	1,99	8.	13,2
Quarter	125	8	0,99	4.	6,6
Eighth	62,5	4	0,49	2.	3,3
Once	31,3	2	0,24,	1.	1,6
Half	15,6	1	0,12	0.	8,8
Quarter	7,8.	0	12,06	0.	4,4
Gros	3,9	0	6,03	0.	2,2

COMPARISON OF LINEAR MEASURES.

Mesures usuelles.	Metres.	English Measure. Feet.	Inches.	Parts.
Toise usuelle	2	6	6	9
Pied, or Foot	$0\frac{1}{6}$	1	1	$1\frac{1}{8}$
Inch	$0\frac{1}{72}$	0	1	$1\frac{1}{8}$
Aune	$1\frac{1}{5}$	3	11	3
Half	$0\frac{3}{5}$	1	11	$7\frac{1}{2}$
Quarter	$0\frac{3}{10}$	0	11	$9\frac{3}{4}$
Eighth	$0\frac{3}{20}$	0	5	$10\frac{7}{8}$
Sixteenth	$0\frac{3}{40}$	0	2	$11\frac{7}{16}$
One-Third of an Aune	$0\frac{2}{5}$	1	3	9
Sixth	$0\frac{1}{5}$	0	7	$10\frac{1}{2}$
Twelfth	$0\frac{1}{10}$	0	3	$11\frac{1}{4}$

The usual or common measures of capacity may be easily computed from table page 22.

ENGLISH WEIGHTS AND MEASURES.

In order to obtain a proper knowledge of the present state of English Weights and Measures, a view should be taken of their history, which will account for various regulations that may require explanation. The following sketch, which has been selected from good authorities, is therefore attempted.

A Catalogue or Synopsis is added of the numerous laws on the subject set down in the order of time in which they were enacted.

New Tables are also given of English weights and measures, with their proportions to those of France. From these tables any other proportions may be easily computed.

Thus suppose it were required to reduce 20 quintals metriques (each 100 kilogrammes) into avoirdupois weight; say

	Kil.		Oz.		Kil.		Oz.
As	1	:	35,3	::	2000	:	70600

or 39 cwt. 1qr. 16lb.

HISTORY

OF

ENGLISH WEIGHTS AND MEASURES.

THE state of English Weights and Measures, before the Norman Conquest, is but imperfectly known; and even for a considerable time after that period their history is both vague and inaccurate. What, for instance, can be more uncertain than the mode adopted by Henry I. of making the length of his arm the standard for long measures? A better law, however, was enacted by Richard I. who ordered that measures of length should be made of iron, and those of capacity should have brims of the same metal; and that standard weights and measures of every kind should be kept by the sheriffs and magistrates of towns; but it does not appear that this law was duly enforced or observed.

"It is declared by *Magna Charta*, (says Mr. Reynardson),* that there should be

* This account of English weights and measures is selected from Mr. Reynardson's paper, in the Philoso-

throughout the realm, one measure of wine,* one of ale, and one of corn, viz. the quarter† of London; and that it should be of weights as of measures.

This declaration has been repeated in many subsequent laws;‡ and, by several of them, the treasurer is directed to provide standards

phical Transactions of 1749; also from Parliamentary Reports, and other authentic documents published since that period. Mr. Reynardson's paper is considered a very valuable dissertation. It was entirely copied by the intelligent Postlethwayt into his Commercial Dictionary, who declares that he should be wanting to his readers, did he omit any part of "the most accurate and satisfactory account of the weights and measures of England ever published." It should be observed, that the numerous references to acts of Parliament greatly enhance the value of the performance.

* Bishop Fleetwood says, it was a good law of king Edgar, that there should be the same weights and the same measures throughout the realm, but it was never well observed. Chron. Pretiosum, p. 34.—And 2 Inst. p. 41, says, this law was grounded upon the law of God, Deut. xxv. ver. 13, 14.—And that there were good laws for weights and measures made before the conquest by Canute. See Custom. de Norm. c. 16.

† See hereafter the contents of a quarter.

‡ 51 Hen. III. stat 6. 14, 25, and 27 Edw. III. 13, 15, and 16 Rich. II. 9 Hen. VI. 2 Hen. VII. cap. 4. 16 Car. I. and 22 Car. II. cap. 8.

of bushels, gallons, and weights of brass, and to send them into every country; and all measures are to be made according to the king's standard, the assize whereof is established by several laws,* as follows: the English penny, called a sterling round, without clipping, to weigh 32 grains of wheat dry, and taken from the midst of the ear; 20 pence make an ounce; 12 ounces a pound; 8 pounds make a gallon of wine; † 8 gallons of wine make a London bushel,‡ which is the eighth part of a quarter. And by other laws§ it is declared, that the tun of wine, oil, and honey, should contain of the English measure, according to the ancient assize, 252 gallons; the pipe, or butt, 126; the tertian 84; the hogshead 63; and every barrel 31½, according to the old assize, and to be gauged by the king's gauger.

In the reign of Edward III.‖ an act passed

* 51 Hen. III. stat. 1. cap. 3. 31 Edw. I. 12 Hen. VII. cap. 5.

† The 12th Hen. VII. cap. 5. says wheat.

‡ 9 Hen. VI. c. 8. says,—Buyers of corn in London, bought by a vessel called a fat, containing nine bushels of corn; which is forbid by the act.

§ 2 and 18 Hen VI. 1 Ric. III. cap. 13. 5 Ann. cap. 27. sect. 19. 23 Hen. VIII. cap. 7. 2 Hen. VI. cap. 11.

‖ 25 Ed. III. stat. 5. cap. 9. 31 Ed. III. cap. 5. 8 Hen. VI. cap 5. 9 Hen. VI. cap 8.

to take away the weight called auncell,* whereby, and by subsequent statutes, it is directed that every sale and buying should be by the even balance.

In the 11th year of Hen. VII. complaint being made to the parliament, that the ancient statutes and ordinances of the realm relating to weights and measures had not been observed and kept, it was therefore enacted, That there should be delivered to the knights and citizens of every shire and city, one of every weight and measure, which the king had caused to be made of brass, according to his standard in the Exchequer, to be delivered to the respective places mentioned in the act; and that the inhabitants of all cities, boroughs, and market towns, should make and use weights and measures made according to the weights and measures so delivered as aforesaid. In the next year, another act passed, reciting, That the king had made such weights and measures of brass, according to the old standard thereof remaining within his Treasury; which weights and measures, upon more diligent examination, had been proved defective, and not made accord-

* King Stephen, says Knighton, settled measures of length and of land, and made appointments de ansulis, bilancibus, &c. Decem Scriptores, p. 2391.

ing to the statutes and old laws, and were therefore recalled, and ordered to be broken, and other new bushels and gallons were directed to be made and sized, according to a new bushel and gallon to be made according to the assize, to remain in the king's Exchequer: where we now find a bushel, in the custody of the Chamberlain, called the Winchester bushel,* and a gallon agreeing thereto. Upon the bushel there is the following inscription:— Henericus Septimus, Dei gratia, rex Angliæ et Franciæ.

In the last-mentioned act, the assize for weights and measures is in substance the same as in the old statutes, only the pound is said to be the pound troy of 12 ounces. But since, by this and the former assize laws, the pound is directed to be raised from 240 sterling pennies, it follows, that the gravity of the assize pound was always the same; but the dimensions of

* The first time that I find it called so by any law, is in an act 22 Car. II. cap. 8. And afterwards it is called by this name in several acts of parliament; but in the act just now mentioned, it is said to be commonly called the Winchester measure: perhaps it first took that name from the statute made at Winchester, 16 Rich. II. which directs the clerk of the market to have all his weights and measures ready, and marked and signed according to the standard of the Exchequer.

measures of capacity respectively, raised from a pound of wine and a pound of wheat, will be in proportion to each other as the specific gravity of wheat is to that of wine or water.

Thus continued the laws relating to the English standard of weights and measures, till after the restoration, when a duty of excise * being laid upon beer, ale, and other liquors, 36 gallons taken by the gauge, according to the standard of the ale quart (4 whereof made the gallon remaining in the Exchequer) were to be reckoned as a barrel of beer, and 32 such gallons a barrel of ale; and afterwards, † 34 such gallons of vinegar (and of beer or ale, stronger or smaller) without the bills of mortality, were declared to be a barrel; and all other liquors liable to the excise-duty were to pay according to the wine gallon.

We now find the officers of the revenue determining the contents of our measures of capacity with great exactness: for, on the 25th of May, 1688, two general officers of excise, in the presence of the Lord Mayor, the commissioners of excise, Mr. Flamsteed, and others, upon an

* 12 Car. II. cap. 24. §. 20.

† 1 Will. and Mar. cap. 24. §. 5. 10 Will. III. cap. 21. 11 and 12 Will. III. cap. 15.

exact trial found, that the old standard wine gallon, kept in Guildhall, did contain but 224 cubic inches; nevertheless, at that time, it was thought convenient to continue the former supposed content, being 231 cubic inches, as the standard wine gallon, and which has since been established by law.*

In the year 1696, an experiment was made, in order to fix the true and exact contents of the brass standard bushel of Henry VII. which being filled with common spring water, and the water measured out with great nicety and exactness, the bushel † was found to contain 2145,6 solid or cubic inches; and the water being weighed by the standard weights in the Exchequer (and by a beam, which would turn with six grains put into either scale, with 30 pounds in each scale) was found equal to 1131 ounces 14 pennyweights troy; and at the same time and place the standard troy weights were compared with the standard avoirdupois, and 15 pounds of the latter were found equal to 18 pounds 2 ounces 15 pennyweights troy, which

* 5 Ann. cap. 27. §. 17.—This act says, any cylinder 7 inches diameter, and 6 inches deep, or any vessel containing 231 cubical inches and no more, shall be a lawful wine gallon.

† Everard's Stereometry, p. 193.

fixes the pound avoirdupois at 7000 of such grains as the troy pound weighs 5760; and upon three several trials, made by the gentlemen of the council of the Royal Society, at the Exchequer, upon a medium, the avoirdupois pound was found equal to 7000,25 troy grains.

By the first * malt act, which passed soon after the making the experiment upon the Winchester bushel, it is declared, that every bushel 18 inches and half wide, and 8 inches deep, should be esteemed a legal Winchester bushel: and the coal bushel is directed † to be made 19 inches and a half diameter, and to contain the last bushel and one quart of water. The first contains 2150,42 cubic inches, the last 2217,47. We now see different measures established by law, ‡ and, under the excise laws, two different gauges or measures, used for taking the dimensions of wine and ale vessels. The wine gallon contains 231 cubic inches, and the ale gallon 282; but upon what foundation this last measure was established, is difficult to determine.

* 13 Will. III. c. 5. §. 28. and 1 Ann. stat. 2. c. 3. §. 10.

† From outside to outside, 12 Ann. stat. 2. c. 17. §. 11.

‡ Though contrary to Magna Charta, and several other laws not repealed.

Troy weights had for some time been established and used for the money affairs in the mint, and for weighing gold, silver, and some few commodities; and the avoirdupois were in general use for weighing all heavy and gross commodities. Wine measure was generally looked upon as equal to troy weight: from hence the managers of the excise duty were, perhaps, led to fix the standard of the ale gallon, bearing the same proportion to the wine gallon, as the avoirdupois pound did to the troy; and, according to this conjecture, the two gallons answer pretty exactly,* the ale gallon exceeding the proportion by somewhat more than one cubic inch and one quarter; but it exceeds the Winchester gallon, or 268,2 cubic inches, by very near 14 cubic inches: and not one of these measures is agreeable to the words of the assize, which directs,† 'That the bushel shall contain 8 gallons of wheat, the gallon 8 pounds of wheat of troy weight, the pound 12 ounces of troy weight, &c. according to the old laws of this land.' It is very plain the law-makers, in Henry the VIIth's time, took the troy weight for the

* For, as 144 : 175 : : 231 : 280,729—And as 144 : 175 : : 224 : 272,222. This last comes very near the vulgar dry gallon.

† 12 Hen. VII. c. 5.

standard ; and most authors who have written upon this subject, have followed their example.

The great difficulty we are under in fixing upon a standard pound, agreeable to the assize, arises from the uncertainty of the rule laid down in our laws of assize for raising the pound from 7680 grains of wheat, as these grains differ in weight in different countries, and in different years ; I might have said in the same field and in the same year.

The uncertainty of a pound so raised might, with great probability, occasion the variety in our weights and measures, so often complained of in our ancient laws, and for the prevention whereof Edward III. in his 14th year, ordered ' standard weights and measures to be made of brass, and sent into every city and town in the kingdom.'

The laws of assize never received any alteration, except by the 12th of Hen. VII. when the pound is declared to contain 12 ounces of troy weight*, and the gallon 8 pounds of wheat

* This is the first time the standard weights are called troy weights. But, in an act 2 Hen. V. stat. 2. c. 4. and 2 Hen. VI. c. 13. relating to goldsmiths, there is mention made of the pound of troy.

of troy weight; and, since the laws have received no change, we have great reason to conclude, that the standard weights themselves never suffered any addition or diminution; but, however this be, we* now find, in the custody of the proper officer of the Exchequer, two sets of weights, kept there as standards; one called troy, the other avoirdupois weight.

As there is no account handed down to us by our ancestors, shewing at what time, and upon what occasion, these weights, differing considerably in gravity from each other, were there first deposited, we are at a loss to determine which is the ancient standard weight described by the laws of assize. The act in the 12th of Hen. VII. has called the standard weight by the name of troy weight; this is the

* Phil. Trans. No. 470.—The avoirdupois weight of 14 pounds is marked with a crowned E, and inscribed,

XIIII Povnde Averdepoiz.
Elizabeth. Regina.
1582.

The troy weights, marked with a crowned E, are ounces, from 256 down to the 16th part of an ounce: and there are no whole pounds troy, pennyweights, or grain weights, at the Exchequer. There not being pounds, or greater weights, seems to be a proof, that these weights were never designed or used for determining the weight of large bodies or heavy goods.

first time the weights are so called in any of our assize laws; and, notwithstanding this authority, it will be found very difficult, if not impossible, to reconcile the troy weight and measure raised therefrom with the words of the assize, and any measures now in being; for the natural and most ready way to determine this question, is to compare both the troy and avoirdupois weight with measures raised from each, according to the rule laid down in the assize, and with such measures as are or have been used by authority.

'The most exact* geometrical way of ex-
'pressing the capacity of any vessel or measure,
'is by expressing in known terms the solidity
'of a body, which will precisely fill it: the
'fittest will be water. The solidity of all
'bodies is best expressed by the help of a
'cube, whose equal sides we know by a
'standard measure or length; and it appears,
'that this way of determining measures of
'capacity is not only the most geometrical,
'but also exceeding ancient.'†

* Bishop Cumberland's Essay, p. 60.—who also says, the Egyptians made their ardob the cube of their known standard the cubit.—And that the Romans made their quadrantal the cube of their standard the foot.

† Measures of bodies are either determined by their so-

By this rule some gentlemen at Oxford, in the year 1685, determined the weight of a cubic* foot of spring water, or 1728 solid inches, to be 1000 ounces avoirdupois, and by the same rule the capacity and contents of the standard bushel in the Exchequer were determined in the year 1696, with great care and exactness: by the same rule, the contents of other vessels of capacity have been settled; and, in the following table, I have inserted the names of such measures as are of any authority, whose contents are known; by which the proportion they bear to each other, and to measures raised according to the assize, as well from the pound troy as the pound avoirdupois, will be readily observed.

In the next place, let us compare the experiment made upon the cubic foot of spring water with that upon the Winchester bushel, and we shall find an uniform and perfect agreement between them; and that, upon each trial, a cubic vessel, the sides whereof were equal to an English foot, did contain † 1000

lid contents, or weight. Measures of contents are formed from cubes of assigned lengths. Bishop Hooper, p. 2.

* Phil. Trans. No. 169.

oz. pw. cu. in. oz. cu. in.

† For as 1131 : 14 troy : 2145,6 :: 1000 avoir. :: 1,728,041.

Some writers upon this subject say, that a cubic foot of

ounces avoirdupois of spring water. From hence we are led to the discovery of a natural and universal standard for the English weights and measures; and such an one as is, in every respect, agreeable to the words of the assize recorded in our most ancient laws.

Magna Charta points out the quarter of London, as the only standard for measures and weights of that time, but we are left to guess of what measure or weight it was the quarter part. If we suppose it the quarter of a ton, or 2000 pounds weight, then the quarter was 500 pounds, and the eighth part of that, or a bushel, was equal to a cubic foot, or $62\frac{1}{2}$ pounds, from whence less measures and weights were easily deduced. Subsequent assize laws direct the greater measures to be raised from the less; that 8 pounds should make a gallon, 8 gallons a bushel, which was to be the eighth part of a quarter; and by this rule the quarter

spring water is equal to 76 pounds troy, which is 10 pennyweights 20 grains more than the 1000 avoirdupois. See Arbuthnot's Tables explained, p. 80, 283. Bishop Hooper's State, &c. p. 11.—But the explainer of Arbuthnot's Tables seems to have been quite ignorant of any experiment since Sir Jonas Moore's time; and to have disregarded the due proportion between the avoirdupois and troy pound; and, for 175 to 144, his tables, he says, are calculated at 17 to 14.

is raised to 512 pounds, and the ton to 2048 pounds. These measures and weights are raised with ease from known parts of the foot. For a cubic vessel, whose sides are equal to $\frac{1}{10}$ of a foot, will contain a cube of spring water equal to an ounce avoirdupois ; and from hence, by a regular geometrical progression, we shall obtain cubes equal to * 8—64—512 ounces, or to 4—32—256—2048 pounds avoirdupois : and, from a cubic vessel containing one such pound, we shall have other cubic vessels, equal in weight 8—64—512 pounds ; and in measure to the gallon, bushel, and quarter, according to the assize.

The † gallon, bushel, and quarter, are called dry measures, and are used for ascertaining the quantity of corn, and other dry goods ; the gallon ‡ is also a liquid measure raised from a pound, in liquids now called a pint,§

* Eight ounces are equal to a mark, whereof two, or twice the contents of that cube, make a pound avoirdupois.

† The half bushel, peck, gallon, pottle, and quart, are directed by 25 Edw. III. stat. 5. c. 10. to be made according to the king's standard.

‡ See Bishop Hooper, p. 6.

§ See note hereafter.—The pint is not mentioned in the assize laws ; but Bishop Hooper has given a long and learned dissertation upon that measure, and calls it the pint of old, p. 458.

from whence all the other liquid measures are raised; but with this difference in the proportion, that the liquid bushel is not 64, but 63 pounds or pints, eight whereof make the hogshead equal to 63 gallons; from whence the contents, as well of the larger as smaller vessels or measures of capacity, are settled.

The measures of capacity, thus raised, are sufficiently convenient for common use, and are generally retained at this time; but, for weights, there has been some variety from time to time, in the composition of the larger sort, used for determining the weight of merchandize and heavy goods, as will appear from the following extract from several old acts of parliament.—The stone for weighing lead was settled at 12 pounds;* for wax, sugar, spices, and alum, at eight pounds; of which last, 13½, or 108 pounds made the hundred weight; the sack of wool † was to weigh but 26 stone, 14 pounds to each stone: a weye of ‡ cheese 32 cloves, each clove 7 pounds. And for many years past, the hundred weight has been fixed §

* Cay's Abridgement, title Weights, § 9.

† 25 Edw. III. stat. 5. c. 9. 13 Rich. II. c. 9.

‡ 9 Hen. VI. c. 8. The weye equalled 224 pounds.

§ That is, 14 stone at 8 pounds, or 8 stone at 14 pounds each, according to the old laws and present usage of the stone weight. The 112 pounds is a very convenient weight

at 112 pounds avoirdupois, and that by a general consent, and without any particular law to establish it.

These weights have been universally and immemorially* used in England, with an exception to the weighing of gold, silver, and some very few commodities, for which the troy weight has been used for many years. When it was first introduced into this kingdom, does no where appear; but Mr. Folkes, in his Tables of the English Silver Coins,† tells us, it

for a standard, because it is divisible into more even parts than any less number.—And it is compounded from the assize bushel, its half and quarter; that is to say, 64, 32, and 16 pounds.

* The apothecaries (who next to the goldsmiths, are supposed to make the most use of troy weights) seldom keep weights adjusted to the troy pound heavier than two drachms; but, for all above, buy and sell by avoirdupois: and with them, by the term libra in measure, is meant the wine pint; though this measure is not, say they, so denominated, from its containing an exact pound weight of any liquor; and the term uncia in measure does not denote a twelfth part of the pint, but the sixteenth, though in weight agreeable to its signification, it is used to express one twelfth part of a pound; so that an ounce in measure is scarce more than three quarters of an ounce in weight. See Pemberton's Dispensatory, p. 44.

† Mr. Folkes says, The pound used at the mint before that time, called the tower or the moneyer's pound, was

was not established or used at the mint before the 18th of Hen. VIII.

By reducing the liquid bushel, or one eighth of the hogshead, from 64 to 63 pints, it seems plain, that our ancestors took the cubic foot for their model; the contents of such a vessel being $62\frac{1}{2}$ pints or pounds: and from hence, and from what has been shewn before, it is not very unnatural to conclude, that at first our ancestors fixed and established, as well their weights as measures, from known parts of this model; taking always a whole number for each primary weight or vessel, and from thence proceeding, by a regular geometrical proportion, to raise the greater weights or measures: so that the English foot (the undoubted and universal standard of all measures of length within this realm) is also the standard for the

equal to 5400 troy grains: and, p. 13, 14, that the weight of the groat, from 13 Hen. IV. to 4 Edw. IV. was equal to 60 such grains. Which is agreeable to what is said in an act of parliament of 2 Hen. VI. that the pound troy of coined money was worth 32 shillings; for 32 shillings, or 96 groats, 60 grains each, weigh 5760 grains, or a pound troy. Though by the same act, by reason of the scarcity of silver money, and in order to bring bullion into the mint, it was enacted, That silver uncoined, of the same goodness as the money, should be sold only for 30 shillings the pound troy.

avoirdupois* weights, and all measures of capacity.

Upon the whole, therefore, I think it is sufficiently proved, that a cubic vessel, whose sides are equal to an English foot, will con-

* The very name avoirdupois, by which our common weights are known, has by some been looked upon as a proof that they were of foreign extraction. The first time I find the word used in our laws, is in an act of Edw. III. stat. 1. where it is applied to wines as well as corn: as it is afterwards in 25 Edw. III. stat. 3. c. 2. and 16 Rich. II. c. 1. And in an act 27 Edw. III. stat 2. c. 10. there is the following clause: 'Because we have perceived some merchants buy avoirdupois merchandizes by one weight and sell by another, we will and establish, that one weight, one measure, and one yard, be through all the land; and that wools, and all manner of avoirdupois, be weighed by even balance.' This king, in his 14th year, had directed standard weights to be made of brass, and sent into every city and town; and I conjecture, that those standards, from the words of the foregoing clause, took the name of avoirdupois, and were the weights by which the merchant used to buy. What were the lighter weights by which they sold, does not appear, perhaps the pound troy. That the former were the lawful weights, appears by an act 24 Hen. VIII. c. 3. where they are so called; and butchers, who before that time sold their meat by hand, were thereby obliged to provide themselves with beams, scales, and weights sealed, called haberdepois (for avoirdupois); and, in the next reign, the avoirdupois weights, now remaining as standards in the Exchequer, were deposited there, as appears from the name and inscription thereon.

tain 1000 ounces avoirdupois, or very near the weight of spring water ; that weights and measures, deduced by a regular geometrical progression from such a vessel, or from cubic vessels, whose sides are equal to known parts of an English foot, bear an exact analogy to each other, and to weights and measures raised from a pound, according to the words of our most ancient assize laws. This being considered, and that the avoirdupois weight is now in common use for determining the gravity of all heavy bodies ; that this weight now is, and immemorially has been used, for settling the ancient duty of tonnage and poundage, upon all goods and merchandize taken by weight (except some few drugs, which are charged in the book of rates by the ounce troy) ; and that there is not the least proof, either in our ancient or modern laws, to induce a belief that this duty was ever generally taken by the troy weight, or that troy weights were ever in general and common use in this kingdom : it must surely be allowed, that the weight mentioned in our old laws, or acts of parliament, was the avoirdupois weight."* *So far Mr. Reynardson.*

* On the above principle, the Committee of the House of Commons of 1814 formed their plan, differing from the recommendation of the Committee of 1758 ; as may be seen in the following account of their Report, p. 59.

An Account of the Proceedings and Report of a Committee of the House of Commons appointed in 1758, "*to enquire into the original Standards of Weights and Measures in this Kingdom, and to consider the Laws relating thereto.*"

Early in the sessions of 1758, a select Committee of the House of Commons was formed to enquire into the state of English weights and measures, and to report accordingly. They were assisted in their researches by several Mathematicians and Mechanists, among whom may be mentioned Mr. Bird, the celebrated Optician, and Mr. Harris, the King's Assay Master of the Mint, an intelligent author on Coins and other subjects relating to his office. The Committee pursued their enquiry with great system and ability, as their report fully evinces, which is considered the most elaborate and correct statement ever published on the subject. In the following year the enquiry was resumed, and a second Report was made, which, however, may be considered as a continuation of the first. The statement of laws and regulations is very full and methodical. But as it is partly founded on Mr. Reynardson's Paper, it may be sufficient here to arrange those different statutes briefly in the

order of time in which they were enacted, which Synopsis will conclude this article. In such a task repetitions are unavoidable, but such are more excusable than omissions where utility is the object.

The Report, after giving an account of the various laws and revisions relating to weights and measures, from the time of Magna Charta downward, gives a description of the several standards kept in the Exchequer and at Guildhall, with the result of numerous trials and comparisons, as to the proportions of the divisions and multiples of those standards; results which were by no means satisfactory, particularly with regard to measures of capacity.

On this subject the Committee, after giving the legal contents in cubical inches of the several measures, state the following important regulations and opinions.

"All measures of capacity of the same denomination, whether of liquids, or of dry goods, are to contain the same number of cubical inches, and all goods measured by such measures, are not to be heaped, but stricken with a round strike of the same diameter from one end to the other.

" These qualifications prevent the measures subject to them from being applicable to several commodities, in the measuring of which a bushel has been used; as coals, lime, turnips, apples, potatoes, and the like, which several things cannot be stricken; and therefore the bushel cannot determine the quantity of them; for it becomes by this means only a cylinder of $18\frac{1}{2}$ inches diameter, and eight inches deep, or (for coals) $19\frac{1}{2}$ inches diameter, on which an irregular pyramid is erected according to the skill of the person employed in the performance.

" The most obvious and natural method of discovering the quantity of such commodities is manifestly by weight, but the general usage of applying measures to them, and the legislature having adopted that method, and endeavoured to enforce it, your Committee submit whether any new regulations in respect to those commodities should be made, or if they should be left as the law now stands.

" It being suggested to the Committee, that fixing the number of cubical inches which measures of capacity were to contain, might not, without some farther regulation, be sufficient, especially in the larger measures, because in all compressible goods the depth of

the measure would occasion its holding more by the weight of the commodity, than a measure of the same capacity, broad and shallow, would contain: and although upon trial made before your Committee, with great exactness, by Mr. Bird, it did not appear, that the difference in wheat, measured by a deep, and also by a shallow instrument, was at all considerable, yet, as there might by that means be room left for artifice and slight, it was thought necessary to state that the bushel should not exceed 8 inches in depth, the peck $5\frac{1}{2}$ inches, and the gallon 5 inches, for dry goods only, since liquids are not in their nature compressible. Your Committee must, at the same time, observe, that, if the above regulation of the depth of dry measures is thought proper, it will be attended with this inconvenience, that there must be two different sorts of measures of the same capacity and denomination, one for dry goods, and the other for liquids, because the last not only do not require such a restraint of the depth, but cannot, with convenience in practice, admit of such shallow measures; and the permitting of such different forms of measures may introduce many greater frauds and evils, than the restraint will remedy."

But the labours of the Committee were not confined merely to those researches and recommendations; they prepared with great accuracy two standards, namely, the yard, and the pound troy, which are still carefully preserved, and justly considered of the first authority. The following is their account of the means pursued in preparing those standards.

"Your Committee being informed that, in the year 1742, several Members of the Royal Society were at great pains in taking an exact measure of these standards, by very curious instruments, prepared by the late ingenious Mr. Graham; and that the Royal Society had a brass rod made pursuant to their experiments; your Committee applied to the Royal Society for the inspection of it: and it being readily communicated, your Committee compared it with the standard in the Exchequer, and examined Mr. Harris, who said, that a lineal or longitudinal measure should be the standard of all measures of capacity; and as the law seemed already to have made the yard the standard, he thought, that to prevent variations, it should be a clean straight brass rod, of about thirty-eight or thirty-nine inches long, and about an inch broad and thick; near each end of this rod, a fine point should be made,

and a fine line drawn through it at right angles to the sides of the rod; the distance between the said two points to be the true standard length of a yard; and as the edges of points made in brass were liable to decay, he would recommend two gold studs or pins, to be fixed in the brass rods, on which the points were to be made which ascertain the length of the yard. This rod should be fitted in a proper box, and placed in safe custody, to be used occasionally; but that for the ordinary sizing of yards, there should be another rod made, in the same manner as the former, only it should have two upright fixed cheeks; by these cheeks, any thing placed between them might be more readily and exactly measured than by the standards now at the Exchequer; and the standard yard being once fixed, the legislature need only declare what proportion an inch, foot, perch, or mile, bears to this standard; and in like manner, declaring how many square perches make an acre, and the like, there will be exact standards for all these kept in the Exchequer.

"And he observed, that the rods at the Exchequer, and that of the Royal Society, were rather too small, but the Royal Society's standard was made so accurately, and by

persons so skilful and exact, that he did not think it was easy to obtain a more exact one; and therefore he humbly advised a comparison to be made by the Committee, and submitted whether the Committee would think proper to have a rod made in consequence of that comparison for security.

"Your Committee thought it was necessary to pursue Mr. Harris's thought, and therefore had two rods made by Mr. Bird, according to Mr. Harris's proposal; and having those rods, together with that of the Royal Society laid in the same place, at the receipt of the Exchequer, all night, with the standards of length kept there, to prevent the variation which the difference of air might make upon them, they the next morning compared them all, and, by the means of beam compasses brought by Mr. Bird, found them to agree as near as it was possible. The rods which they had thus prepared, were sealed up by your Committee, and are herewith laid before the house to be disposed of as shall be thought most proper.

"That which your Committee thinks should be the proper standard, if the Legislature shall think fit to make it so, and carefully preserved, is marked thus, "Standard yard, 1758;" and

the other with the cheeks, is what your Committee would propose to be kept at the receipt of the Exchequer for common use, and is divided into three equal parts, each of which is consequently a foot; one of those third parts into twelve making inches, and one inch into ten equal parts, for the easier adjusting of any comparative measure."

On the subject of the standard pound, the Committee reported as follows.

"And there appearing such considerable difference in these standard weights, in whatever way they were tried, your Committee examined Mr. Harris, to know what might be the most proper manner of discovering the true weight of the pound troy, and also of the avoirdupois pound, and the proportion between them, in order to ascertain some standard which should be uniform, and preserve a due proportion as well in its parts as in its multiples; And

"Mr. Harris informed your Committee, that he thought the pound was, properly speaking, the fittest denomination of weight, for the hundred refers to the pound, as the ton does to the hundred; and the pound seemed

of a convenient size for the unit, or standard measure of weight; because without being too cumbersome, it is big enough to be artificially divided into many parts; but as there are two sorts of weight in common use, troy and avoirdupois, it may be questioned which of these should be the standard; for there cannot, with any propriety, be more than one standard; and this he thought should be the troy pound, for these reasons:

"Because it is the weight best known to our law; that which hath been longest in use; that by which our coins are measured; that which is best known to the rest of the world; that to which our learned countrymen have referred, and compared ancient and foreign weights; the weight which hath been subdivided into the smallest parts: on the other hand, the avoirdupois weight is of doubtful authority; and, though unfit to be made a standard, yet the frequent use of it renders it necessary to ascertain and declare how many ounces, pennyweights, and grains, troy, the pound avoirdupois ought to weigh."

Such was the opinion of the Committee of 1758, as to the proper standard for weights, which was agreed to by the House, and further

confirmed and acted upon by the Committee of 1759, who thus observe in their Report.

"Your Committee thought it necessary in the first place to obtain, with the utmost possible exactness, standard weights of the several parts of the said pound troy, in order that from thence such other combinations, or proportions of weight might be formed, as the business or necessities of the subject should hereafter require. And Mr. Harris was employed to make these several parts, who accordingly did so, with great skill and attention, by a very curious and accurate apparatus contrived by Mr. Bird. It was adapted to five different beams, which ascertained the weights from twelve ounces, or one pound, down to a grain inclusive; and that with so great exactness as to discern any error in the pound weight to the 230,400th part of the weight, and to the 2000th part of a single grain.

"By these beams the several parts of the standard pound were examined and adjusted by Mr. Harris, in the presence of your Committee, and were found to be what their denominations import. These several parts were tried in every progressive combination necessary to discover their proportions to each other."

Here the Committee give tables of the various combinations of those standard weights; after which they observe, "Upon all these trials, the several weights appeared to your Committee so exact, that no greater degree of correctness could, in the nature of the thing, be expected."

A copy of this standard pound was delivered to the House of Commons, and another to the King's Assay Master of the Mint, in whose office it is still preserved, with Mr. Bird's weighing apparatus:* numerous other copies have been since distributed.

* With the above standard and apparatus, some very accurate trials have been lately made by Robert Bingley, Esq. F.R.S. the King's Assay Master of the Mint. One of these deserves particular notice, as tending to confirm the proportion between troy and avoirdupois weight, which proportion had been differently stated in works of high authority, varying from 6998 to 7010 grains troy to the pound avoirdupois. It was, however, found, by the trial just mentioned, that the avoirdupois standard pound, kept in the Mint, weighs exactly 7000 grains troy; and it was further ascertained that this pound perfectly agrees with the bell standard pound at Guildhall, and also with that (of 1588,) kept at the Exchequer, and this agreement was the more curious and satisfactory, as the Mint avoirdupois pound had always been kept carefully packed up in paper, while the other two standards were constantly in use, and exposed to the atmosphere. See *Universal Cambist, Vol.* 1. *p.* xv.

Thus ended the labours of the Committee, and it is to be regretted that no further parliamentary proceedings were continued, as the plans, preparations, and talents, manifested on the occasion, augured well for the correction and improvement of British Metrology; but it may be concluded, that the Committee were not sanguine in their hopes of being able to establish uniformity, if an opinion may be formed from the following declaration. (Report, p. 460.)

"The repeated endeavours of the Legislature, ever since *Magna Charta*, to compel the use of one weight and one measure throughout the realm, never having proved effectual, there seems little to be expected from reviving means, which experience has shewn to be inadequate; and yet it is very difficult to devise any thing entirely unattempted by former Parliaments."

On the above observation of the Committee, it may be remarked that although the laudable endeavours of Parliament for so many ages had failed of complete success, yet they were highly useful in preventing new irregularities. The wear indeed of weights and measures, the avarice of dealers, and the ignorance of artificers, especially in constructing measures of capacity,

contribute to increase that diversity which requires the constant vigilance of the magistrate to prevent.

From the foregoing period to the present time, no essential alteration has taken place in the standards of weights or measures, though several laws have been enacted for their regulation in particular departments of business. The object of these new laws, with the periods of their enactment, will be found in the following Synopsis, which has been selected from the best authorities, and is intended to afford a ready reference to persons who may wish to consult the statutes at large.

Although the history of Weights and Measures must consist chiefly of an account of the laws made for their regulation, yet honourable mention should be made of the labours of the learned to correct or improve the system; for though their plans may not have been adopted, they may prove useful on some future occasion. With this view it seems proper to refer to several ingenious papers on the subject in the Philosophical Transactions, chiefly by Messrs. Barlow, Norris, Graham; and Reynardson, (who has been already quoted,) also to the learned communications of Sir George Evelyn Shuck-

burgh, and Dr. Maskelyne.* Respectful notice should likewise be taken of the plan of Sir John Miller, who, in the year 1789 moved for a Committee in the House of Commons "to investigate and report on the best means for adopting an uniformity of Weights and Measures." He suggested to the Legislature the propriety of determining the element of linear measure, by the length of the pendulum vibrating seconds. His plan was supported by ingenious publication by the Rev. George Skene Keith, who recommended that this standard should be divided and multiplied according to the decimal system.†

* Information from the Philosophical Transactions is most readily obtained, by means of the copious Index added to the Abridgement of that valuable Work by Dr. Hutton.

† The pendulum plan with decimal divisions was soon after entertained by the Philosophers of France, but given up for the Metre. It was likewise proposed in America by Mr. Jefferson, and sanctioned by the House of Representatives, in the year 1792, but never acted upon: and here it is important to observe, that the people of the United States, who have always manifested a disposition to improve their laws and constitution, and who have essentially changed their mint regulations from those of England, have made no alteration in their weights or measures, which are essentially English; an adherence that affords no mean testimony in favour of our ancient system of Metrology.

A SYNOPSIS

OF

Laws relating to Weights and Measures.

A. D. 1215.—Magna Charta, *Sect.* 35.

There shall be but one uniform standard of weights, measures, and manufactures; that for corn shall be the London quarter.

1224.—9th Henry III.

Compositio ulnarum et perticarum.
De Admensuratione Terre.
Statutum de Pistoribus.

1266.—51st Henry III. *Sect.* 3.

The Statute entitled "Assisa Panis et Cervisiæ," the prices of bread and ale shall be according to the prices of corn.

1302.—31st Edward I.

An ordinance of measures, entitled Tractatus de Ponderibus et Mensuris. See Appendix.

1304.—33rd Edward I. *Stat.* 6.

An ordinance for measuring land directs, that when an acre of land containeth x perches

in length, then it shall be in breadth xvi perches. The Act continues thus to describe the lengths and the breadths of the acre in various proportions, as if land surveying was not then understood.

1304.—33d Edward I. *Stat.* 6.

The contents of a ton of wine, and the gauging thereof, explained.

1326.—1st Edward III. *Chap.* 8.

Bushels, Gallons, and Ells, shall be signed with the King's Seal; and he that buyeth or selleth with other shall be amerced.

1328.—3d Edward III.

Statutes made at York; *Crastino Ascensionis*, chiefly local regulations.

1339.—14th Edward III. *Chap.* 12.

Bushels and weights shall be made, and sent into every county, with officers appointed to enforce uniformity.

1343.—18th Edward III. *Chap.* 4.

Commissions to assay weights and measures repealed, and none such granted.

1350.—25th Edward III. *Stat.* 5. *Chap.* 9 *and* 10.

Auncel weight shall be put out, and weighing shall be by equal balance.

Every measure shall be according to the King's standard, and shall be striked without heap, saving the rent of lords; that the quarter of corn shall contain eight bushels.

1351.—Edward III. *M.* 14, *Sect.* 25.

It was this year ordained, that the same measures and weights should be used in Ireland that were used in England.

1352.—27th Edward III. *Stat.* 2. *Chap.* 10.

There shall be but one weight, measure, and yard, throughout the realm.

1356.—31st Edward III. *Stat. Westm.* 1*st.* *Chap.* 2 *and* 5.

No wool shall be bought by fraud to abate the price thereof. Weights shall be sent to all shires.

1359.—34th Edward III. *Chap.* 5 *and* 6.

Auncel weight shall be put out; buying and selling shall be by equal balance.

All measures shall be according to the King's standards.

1359.—34th Edward III.

Justices of Peace empowered to enquire of weights and measures.

1380.—4th Richard II.

All vessels of wine, oil, and other liquors, brought into the realm, shall be gauged.

1389.—13th Richard II. *Chap.* 9.

There shall be but one weight and one measure throughout the realm, saving in the county of Lancaster, the weight of wool and the refuse thereof.

1391.—15th Richard II. *Chap.* 4.

There shall be but eight bushels of corn striked to the quarter.

1392.—16th Richard II. *Chap.* 3.

The clerk of the market shall carry with him his weights and measures, signed.

1412.—1st Henry V. *Chap.* 10. *Sect.* 2.

By what measure purveyors and others shall take and buy corn.

1423.—2d Henry VI. *Chap.* 2.

The several measures of vessels of wine, and various kinds of fish.

1429.—8th Henry VI. *Chap.* 5. *Sect.* 2.

Every city and borough shall have a common balance and weight, who may buy wools and yarn.

1430.—9th Henry VI.

For explaining Statute Henry VI. *Chap.* 5, concerning weights and measures, so far as relates to the Burgesses of Dorchester.

1430.—9th Henry VI. *Chap.* 8.

The weight of a wey cheese.

1432.—11th Henry VI. *Chap.* 8.

A confirmation of all statutes made touching weights and measures.

1439.—18th Henry VI. *Chap.* 16.

An Act for the mode of measuring cloth.

1439.—18th Henry VI.

Vessels of wine, oil, and honey, shall be gauged.

1465.—6th Edward IV.

Regulations respecting the measures of cloth.

1481.—22d Edward IV.

An Act for packing of barrelled fish.

1483.—In the only parliament of King Richard the Third, regulations were ordained to abolish the frauds introduced in the clothing trade, with respect to measure, &c.

1483.—1st Richard III. *Chap.* 13.

The contents of vessels of wine and oil, which are not to be sold till gauged.

1491.—7th Henry VII. *Chap.* 4.

Weights and measures shall be made of brass, and sent to the chief officers of every city, borough, &c.

1491.—7th Henry VII.

An Act to pay custom for every butt of Malmsey, with its contents, &c.

1495.—11th Henry VII. *Chap.* 4.

The names of the cities and towns limited for the keeping of weights and measures.

1495.—11th Henry VII. *Chap.* 5.

For establishing uniformity in weights and measures, by distributing standards or copies from those of the Exchequer, which were to be lodged in the principal cities and towns throughout the kingdom, from which other standards were to be made, sealed and marked,

by persons appointed for the purpose, as at present.

1523.—Henry VIII. *Chap.* 4. *Sects.* 2, 4, 7, 14.

An Act concerning new making of barrels, kilderkins, and other vessels.

1531.—23d Henry VIII.

An Act limiting the prices of wines, with the sizes of beer and ale vessels.

1532.—24th Henry VIII. *Chap.* 3.

Beef, pork, mutton, and veal, shall be sold by weight, called *Haverdupois:* no person shall take for a pound of beef or pork above *ob.* nor for a pound of mutton or veal above *ob. q.* and less in those counties where they be sold for less.

1533.—25th Henry VIII. *Chap.* 1.

Governors of cities and market towns, upon complaint to them made of any butcher refusing to sell victuals by weight, according to the statute of 24th Henry VIII. chap. 3, may, &c.

1536.—28th Henry VIII. *Chap.* 14. *Sect.* 5.

For prices of wine, with orders for gauging and measuring, &c.

1588.—31st Elizabeth, *Chap.* 8.

An Act for the true gauging of vessels, brought from beyond the seas, converted by brewers for the utterance and sale of ale and beer.

1592.—35th Elizabeth. *Chap.* 6.

That the length of a statute mile, for the future, shall be eight furlongs, each furlong containing forty poles or perches, and every pole to contain sixteen feet and a half in length; so that the English mile was hereby to contain 1760 yards in length.

1600.—43rd Elizabeth.

An Act concerning the assize of fuel.

1636.—King Charles I. enjoined that there be only one weight, and one measure, for every commodity to be bought or sold throughout the kingdom; and that his clerk of the market for his household should have the overseeing and examination of all weights and measures; for which consideration, the king hereby appoints certain fees to be paid to him.—*(Fœdera. V.* xx. *p.* 41.*)*

1640.—16th Charles I. *Chap.* 19. *Sect.* 2 *&* 7.

An Act for the better ordering and regulating

of the office of clerk of the market, allowed and confirmed by the said statute, and for the reformation of false weights and measures.

1659.—12th Charles II. *Chap.* 23. *Sect.* 20.

A grant of certain impositions upon beer, ale, and other liquors, for the increase of his majesty's revenue, during his life.

1669.—22nd Charles II. *Chap.* 8. *Sect.* 2, 3, *&c.*

An Act for ascertaining the measures of corn and salt.

1670.—22nd and 23rd Charles II. *Chap.* 12. *Sect.* 2, 3, *&c.*

An additional Act for ascertaining the measures of corn and salt.

1688.—1st William & Mary. *Chap.* 24. *Sect.* 5.

An Act for an additional duty of excise upon beer, ale, and other liquors.

1693.—5th and 6th William and Mary.

An Act for granting to their majesties certain rates and duties upon salt, and upon beer, ale, and other liquors.

1695.—7th and 8th William III.

An Act for continuing to his majesty certain

duties upon salt, glass wares, stone and earthen wares; and for granting several duties upon tobacco pipes and other earthen wares, for carrying on the war againt *France*, and for establishing a national land bank, and for taking off the duties upon tonnage of ships, and upon coals.

1697.—9th and 10th William III.

An Act that all retailers of salt shall sell by weight.

1698.—10th and 11th William III. *Chap.* 21. *Sect.* 15.

An Act for laying further duties upon sweets, and for lessening the duties as well upon vinegar, as upon certain low wines, with various other regulations respecting measures.

1698.—10th and 11th William III.

An Act for the more full and effectual charging of the duties upon rock salt, with directions as to weights and measures.

1699.—11th and 12th William III. *Chap.* 15. *Sect.* 1.

An Act for the ascertaining the measures for the retailing ale and beer.

1701.—13th and 14th William III. *Chap.* 5.

An Act for granting an aid to his majesty by laying duties upon malt, mum, cyder, and perry, with a specification of measures.

1702.—1st Anne. *Stat.* 1. *Chap.* 15. *Sect.* 1 & 2.

An Act to ascertain the water measure of fruit.

1702.—1st Anne. *Stat.* 2. *Chap.* 3. *Sect.* 10.

An Act for granting a supply to her majesty, by several duties imposed upon malt, mum, cyder, and perry.

1702.—1st Anne.

An Act for preventing frauds in the duties upon salt, and for the better payment of debentures at the custom house.

1706.—5th Anne. *Chap.* 8. *Art.* 17. *Union.*

An Act for an union of the two kingdoms *of England* and *Scotland*, in which it is ordered that the English weights and measures shall be adopted in Scotland.

1706.—5th Anne. *Chap.* 27. *Sect.* 17.

An Act for continuing several subsidies, impositions, and duties, and for ascertaining the wine measure.

1710.—9th Anne.

An Act for reviving, continuing, and appropriating certain duties upon several commodities to be exported, and certain duties upon coals to be waterborne and carried coastwise.

1710.—9th Anne.

An Act for making more effectual an Act of the 43d year of the reign of Queen Elizabeth, intituled "An Act concerning the assizes of fuel, so far as it relates to the assize of billet."

1711.—10th Anne.

An Act for explaining and altering the laws now in being concerning the assizes of fuel, so far they relate to the assize of billet made or to be made of beech wood only.

1713.—12th Anne. *Chap.* 17. *Sect.* 11.

An Act for the speedy and effectual preserving the navigation of the river of Thames, by stopping the breach in the levels of Havering and Daggenham in the county of Essex, and for ascertaining the coal measure.

1729.—3rd George II. *Chap.* 26. *Sect.* 11.

An Act for the better regulation of the coal trade.

1734.—8th George II.

An Act for granting and continuing the duties upon salt, and upon red and white herrings, for a term of four years, and for giving further time for the payment of duties omitted to be paid for indentures and contracts of clerks and apprentices.

1741.—15th George II.

An Act to prevent the counterfeiting of gold and silver laces, and for settling and adjusting the proportions of fine silver and silk, and for the better making of gold and silver thread.

1750.—24th George II.

An Act for explaining, amending, and enforcing an Act passed in the thirteenth year of his late Majesty's reign, intituled, " An Act for the better regulation of the linen and hempen manufactures, in that part of Great Britain called Scotland, and for further regulating and encouraging the said manufactures.

1769.—10th George III. *Chap.* 39.

Whereas a register of the prices of corn in the several counties in Great Britain was thought generally useful, the Justices of Peace were directed to give orders at their first quarter sessions after the 29th of September, in every

year, for returns to be made weekly of the prices of every kind of grain, and to cause a standard Winchester bushel of eight gallons to be kept at each market town. The returns are to be transmitted to the Treasury, and there to be registered in a book kept for that purpose, an abstract of which is ordered to be published weekly in the London Gazette. It was also enacted, that a register should be kept of the quantities of corn exported and imported, with the amount of the bounties paid, and duties received, on the same, to be made up from returns to be transmitted from the Commissioners of the Customs in England and Scotland.

1769.—10th George III. *Chap.* 44.

Traders in excisable commodities, found guilty of keeping false weights and scales for weighing their excisable stock, were subjected to a penalty of £100.

1774.—14th George III.

An Act for regulating and ascertaining the weights to be made use of in weighing the gold and silver coin of this kingdom.

1791.—31st George III.

An Act for regulating the importation and

exportation of corn, and the payment of the duty on foreign corn imported, and of the bounty on British corn exported.

1794.—35th George III. *Chap.* 102.

In order to prevent the frauds committed by using false weights and unequal balances, the justices in quarter sessions were directed to appoint proper persons to examine them and to destroy false ones. The justices were also directed to fine the offenders, and to provide standard weights.

1794.—35th George III.

An Act for the more effectual prevention of the use of defective weights, and of false and unequal balances.

1795.—36th George III.

An Act for the better regulation of mills.

1796.—37th George III. *Chap.* 143.

The justices were desired to appoint visitors, at their petty sessions, to examine the weights and balances within their districts, to seize false ones, and to fine those who are found guilty of using them.

1796.—37th George III.

An Act to explain and amend an Act made

in the thirty-fifth year of the reign of His present Majesty, intituled, "An Act for the more effectual prevention of the use of defective weights, and of false and unequal balances."

1797.—38th George III.

An Act for transferring the management of the salt duties to the commissioners of excise, and for repealing the duties on salt, and the drawbacks, allowances, and bounties, paid thereout, and for granting other duties, drawbacks, allowances, and bounties thereon.

1802.—43rd George III.

An Act to repeal the duties of excise payable in Great Britain, and to grant other duties in lieu thereof.

1806.—47th George III.

An Act for repealing the several Acts for regulating the vend and delivery of coals, and for making better provision for the same.

1815.—55th George III.

An Act for the more effectual prevention of the use of false and deficient measures.

1816.—56th George III.

An Act for preventing frauds in the admeasurement and delivery of coals.

STANDARDS

OF

ENGLISH WEIGHTS AND MEASURES.

The standards of English weights and measures are chiefly kept in the Exchequer, from which copies are committed to the care of officers in different parts of the kingdom, who are empowered to examine the weights and measures of their respective districts. From the Exchequer, too, standards are committed to public offices, and likewise to individuals who obtain indentures or licences for sizing, adjusting, and vending weights and measures. The principal office of this kind is Guildhall, where the avoirdupois weights which are cast by the Founders' Company, for the use of the City, and for other purchasers, are sized and sealed. Here also measures of capacity are adjusted by water measure. Standards are also kept at the Tower.* See page 63.

* In 1802 different standards of the English yard were examined with great nicety by Mr. Pictet. The following are the results :

	Inches.
The Parliamentary standard of 1758, by Mr. Bird	36,00023
Royal Society's standard, also by the same	35,99955
Ditto, by Mr. Graham.....	36,00130
Exchequer standard	35,99330
Tower standard.....	36,00400
General Roy's standard (Trigonometrical Survey).....	36,00636

TABLES

OF

ENGLISH WEIGHTS AND MEASURES,

Compared with those of France. With sundry Explanations, &c.

TROY WEIGHT.

				French Grammes.
		1 Grain	=	0,0647
24 Grains	=	1 Pennyweight		1,5539
20 Pennyweights		1 Ounce		31,079
12 Ounces		1 Pound		372,954

The Grain Troy is divided into 20 Mites, the Mite into 24 Doits, the Doit into 20 Periots, and the Periot into 24 Blanks. These divisions are imaginary, but there are real weights of decimal divisions to the thousandth part of a grain.

APOTHECARIES' WEIGHT.

				Fr. Gram.
		1 Grain	=	0,647
20 Grains	=	1 Scruple		1,294
3 Scruples		1 Dram		3,884
8 Drams		1 Ounce		31,079
12 Ounces		1 Pound		372,954

This weight is essentially the same as Troy Weight, but differently divided. It is chiefly used for medical prescriptions: but drugs are mostly bought and sold by Avoirdupois weight.

DIAMOND WEIGHT.

Diamonds and other precious stones are weighed by Carats, the Carat being divided into 4 Grains, and the Grain into 16 Parts. The Diamond Carat weighs $3\frac{1}{5}$ Grains Troy: thus,

Diamond Weight.			Troy Weight.		Fr. Gram.
16 Parts	=	1 Grain	=	$0\frac{8}{10}$ Grains	= ,0517992
4 Grains		1 Carat		$3\frac{1}{5}$ Grains	,2071968

AVOIRDUPOIS WEIGHT.

			Fr. Gram.
		1 Dram ..... =	1,770
16 Drams..... =	1	Ounce	.28,327
16 Ounces.....	1	Pound	.453,246
28 Pounds.....	1	Quarter.....	.12690,899
4 Quarters	1	Hundredweight	.50763,576
20 Hundredweight	1	Ton	.101527,153

The Dram is subdivided into three Scruples, and each Scruple into ten Grains; the Pound or 7,680 Grains Avoirdupois, equals 7,000 Grains Troy, and hence 1 Grain Troy = 1,097 Grains Avoirdupois.

Hence also .....144 lb. Avoirdupois.. = ..175 lb. Troy
and .....192 oz. ditto .....175 oz. do.

The Stone is generally 14 lb. Avoirdupois weight, but for butcher's meat or fish it is 8 lb. Hence the Hundred equals 8 Stone of 14 lb. or 14 Stone of 8 lb.

A Stone of Glass is 5 lb. A Seam of Glass 24 Stone, or 120 lb.

The Fother of Lead is generally 19½ cwt.
at Newcastle, 21 cwt.
at Stockton, 22 cwt.

Hay and Straw are sold by the Load of 36 Trusses.

The Truss of Hay weighs 56 lb. and of Straw 36 lb. The Truss of New Hay is 60 lb. until the 1st of September.

The custom of allowing more than 16 ounces to the pound of butter is very general in several parts of the country.

WOOL WEIGHT.

Wool, like all other common articles, is weighed by the Avoirdupois, but the divisions differ from the above table: thus,

			Kilogr. Gram.
7 Pounds ..... =	1	Clove ..... =	3,172,72
2 Cloves	1	Stone	.6,344,44
2 Stone.....	1	Tod	.12,690,77
6½ Tods.....	1	Wey	.82,499,55
2 Weys.....	1	Sack	.164,981,54
12 Sacks.....	1	Last	.1979,778,52

LONG MEASURE.

					Fr. Metres.
3	Barley corns	=	1	Inch	= 0,0254
12	Inches		1	Foot	0,3048
3	Feet		1	Yard	0,9144
5½	Yards		1	Pole or Rod	5,0291
40	Poles		1	Furlong	201,1632
8	Furlongs		1	Mile	1609,3059
3	Miles		1	League	4827,9179
69	Geographical, or 69½ English Miles		1	Degree	11120,7442

Besides the above, there are the Palm, which equals 3 Inches; the Hand, 4 Inches; the Span, 9 Inches; and the Fathom, 6 Feet.

CLOTH MEASURE.

					Fr. Metres.
2¼	Inches	=	1	Nail	= 0,0571
4	Nails		¼	of a Yard	0,2286
3	Quarters		1	Flemish Ell	0,6858
4	Quarters		1	Yard	0,9143
5	Quarters		1	English Ell	1,1429
6	Quarters		1	French Ell	1,3715

SQUARE MEASURE.

					Fr. Sq. Metres.
144	Inches	=	1	Square Foot	= 0,0929
9	Square Feet		1	Square Yard	0,8361
30¼	Square Yards		1	Square Pole	25,2916
40	Square Poles		1	Rood	1011,6662
4	Roods		1	Acre	4046,6648

The Inch is generally divided, on scales, into tenths, or decimal parts; but in squaring the dimensions of artificer's work, the duodecimal system is adopted:—thus, the Inch is divided into 12 Parts or Lines, each Part into 12 Seconds, and each Second into 12 Thirds.

In Land Measure there are (besides the above Pole of 16½ Feet, which is called Statute Measure) the Woodland Pole of 18 Feet, the Plantation Pole of 21 Feet, the Cheshire Pole of 24 Feet, and the Sherwood Forest Pole of 25 Feet. A Rope in some kinds of measurement is reckoned 20 Feet, 30 Acres is called a Yard of Land, 160 Acres a Hide of Land, and 640 Acres a Mile of Land.

Land is usually measured by a Chain of 4 Poles, or 22 Yards, which is divided into 100 Links. 10 Chains in length and one in breadth make an Acre, which equals 160 Square Perches or 4840 Square Yards.

CUBIC OR SOLID MEASURE.

				Cubic Metres.
1728	Cubic Inches	=	1 Cubic Foot	= ,0283
27	Cubic Feet		1 Cubic Yard	,7645
40 Feet of rough Timber, or 50 Feet of hewn ditto			1 Load or Ton	1,1326 / 1,4157
42	Cubic Feet		1 Ton of Shipping	1,1892

By Cubic Measure marble, stone, timber, masonry, and all artificers' works of length, breadth, and thickness, are measured, and also the contents of all measures of capacity, both liquid and dry.

WINE MEASURE.

			Cub. In.		Litres.
	1 Pint	=	28,875	=	0,4731
2 Pints	= 1 Quart		57,75		0,9463
4 Quarts	1 Gallon		231		3,3785
42 Gallons	1 Tierce		5,614 Feet		158,9673
2 Tierces	1 Puncheon		11,228 Ditto		317,9345
63 Gallons	1 Hogshead		8,421 Ditto		238,4509
2 Hogsheads	1 Pipe or Butt		16,842 Ditto		476,9018
2 Pipes	1 Tun		33,684 Ditto		953,8036

The Pint is subdivided into Halves and Quarters, the latter is called a Gill. A Rundlet is 18 Gallons, and an Anker nine.

ALE AND BEER MEASURE.

			Cub. In.		Fr. Litres.
	1 Pint	=	35,25	=	0,5776
2 Pints	= 1 Quart		70,5		1,1552
4 Quarts	1 Gallon		282		4,6208
8 Gallons	1 Firkin of Ale		1,305 Feet		36,9669
9 Gallons	1 Firkin of Beer		1,468 Ditto		41,5872
2 Firkins	1 Kilderkin		2,937 Ditto		83,1744
2 Kilderkins	1 Barrel		5,875 Ditto		166,3488
1½ Barrel	1 Hogshead		8,812 Ditto		249,5232
2 Barrels	1 Puncheon		10,750 Ditto		332,6976
2 Hogsheads	1 Butt		17,624 Ditto		499,0464
2 Butts	1 Tun		35,248 Ditto		998,0928

DRY MEASURE.

		Cub. In.	Litres.
4 Gills	= 1 Pint	= 33,6	= 0,55053
2 Pints	1 Quart	67,2	1,10107
2 Quarts	1 Pottle	134,4	2,20214
2 Pottles	1 Gallon	268,8	4,40428
2 Gallons	1 Peck	537,6	8,80856
4 Pecks	1 Bushel	2150,42	35,23430
4 Bushels	1 Coom	4,977 Feet	140,93721
2 Cooms	1 Quarter	9,954 Ditto	281,87443
5 Quarters	1 Wey or Load	49,770 Ditto	1409,37216
2 Weys	1 Last	99,540 Ditto	2818,74432

The Winchester Bushel, which is the legal measure for corn and seeds, should be 18½ inches wide, and 8 inches deep. Its contents are therefore as above 2150,42 inches. Corn and seeds are measured in the port of London by striking the bushel from the brim, with a round piece of light wood, about 2 inches in diameter and of equal thickness from one end to the other. All other dry goods are heaped.

There are two other bushels of different shapes, but containing the same quantity, the one called the drum bushel, generally used for the London Granaries, and is 13 inches in diameter, and 16,2 inches in depth; and the other called the farmer's bushel, is chiefly used in the country, its diameter is 15,375 and depth 11,589 inches. These shapes are chosen for the convenience of working and loading; but the shallow vessel or standard, to avoid the effects of pressure in filling, which depth might cause. See p. 56.

A great variety of corn bushels are used in different counties and districts of England, notwithstanding the numerous penalties that have been enacted to enforce uniformity. This diversity however, it is said, is not attended with any material inconvenience; as the farmers and cornfactors are well acquainted with the contents of each measure, the prices are calculated in proportion.

In some places corn is sold by weight, which is the fairest mode of dealing, but not the most convenient in practice. Even where measures are used, it is customary to weigh certain quantities or proportions, and to regulate the price accordingly. The average bushel of wheat is generally reckoned at 60 lb.—of barley 50 lb.—of oats 38 lb. In some places a load of corn, for a man, is reckoned 5 bushels, and a cart load 40 bushels.

COAL MEASURE.

Coals are generally sold by the chaldron, which bears a certain proportion to Winchester Measure.

4 Pecks	=	1 Bushel
3 Bushels		1 Sack
3 Sacks		1 Vat
4 Vats		1 Chaldron
21 Chaldrons		1 Score

The Coal Bushel holds one Winchester quart more than the Winchester bushel; it therefore contains 2217,62 cubic inches. This bushel must be 19½ inches wide from outside to outside, and 8 inches deep. In measuring coals, it is to be heaped up in the form of a cone, at the height of at least 6 inches above the brim (according to a regulation passed at Guildhall in 1806). The outside of the bushel must be the extremity of the cone, and thus the bushel should contain at least 2814,9 cubic inches. Hence the chaldron should measure 58,64 cubic feet.

The chaldron of Coals at Newcastle is not a measure, but a weight of 53 cwt. which is found sometimes to equal two London chaldrons; but the common reckoning is, that the keel, which is 8 Newcastle chaldrons, equals 15½ London chaldrons. In such comparisons, however, there can be no certainty, as coals not only differ in their specific gravity, but even those of the same quality weigh more, measure for measure, when large, than when broken into smaller parts. UNIVERSAL CAMBIST, Vol. 1. p. 259.

FOR MEASURE OF TIME, see p. 25.

WEIGHTS & MEASURES

OF

SCOTLAND.

The early history of Weights and Measures in Scotland, like that in all other countries, is involved in great obscurity;* but from the account of laws on the subject enacted from the fifteenth century to the present time, it might be supposed that great uniformity had been established, and yet it is probable that in no other country in the world, of the same extent, is there so great a diversity.

Macpherson, in his Annals of Commerce, states that so early as the year 1283, the Chamberlain's Court in Scotland made periodical progresses through the whole country, and carried standard weights and measures, in order to prove those kept by the magistrates. Also that, in 1426, the Scottish Parliament ordained that uniform standards of the boll, firlot, half-

* Much curious information and ingenious conjecture, as to the early history of Scottish measures, will be found in *Chalmers' Caledonia*, vol. 2.

firlot, peck, and gallon, should confirm to standards kept at Edinburgh, and should be used throughout the kingdom (Acts, Jac. I. cc. 52, &c.) And again, in 1458, the parliament of Scotland ordained, that, as there was but one king and one law, so there should be but one measure, agreeable to the standard kept at Stirling, and that copies of this standard should also be kept at Aberdeen, Perth, and Edinburgh, (Acts, Jac. II. cc. 73, &c.)

Numerous other laws to the same effect might be quoted, until the year 1707—when, by the article of union, it was enacted that the same weights and measures should be used throughout the United Kingdom, as were established in England. This article, however, has not been much observed, except for goods received from England, as may be seen by the following ample statement of the present state of weights and measures in Scotland, which is copied from the best authorities.*

* It may seem unnecessary that so full an account of the varieties of Scottish metrology should be given at a time when a plan is set on foot for establishing uniformity; but it should be recollected, that, under the circumstance of a great change, a knowledge of the old measures will, for some years, be more wanted, than even before such an alteration had been introduced.

WEIGHTS.

The English Troy Weight and Apothecaries' Weight are used throughout Scotland, in the same manner as in England, with the exception that the Scotch jewellers divide the troy ounce into 16 drops, each drop being 30 troy grains; whereas the English divide it into 20 pennyweights, and a pennyweight into 24 grains, as before stated.

The English Avoirdupois Weight is used for the sale of leather, soap, sugar, tea, flour, candles, and other groceries; also for selling rosin, wax, pitch, wrought metals, some Baltic goods, and all goods brought from England.

Scotch Troy Weight, also called *Amsterdam* and *French Weight*, is used for weighing iron, hemp, flax, Baltic and Dutch goods, meal, butchers' meat, unwrought pewter, and lead, and likewise for some more articles. The pound, 16 of which compose a stone, contains 7,616 troy grains: it is consequently nearly 9 per cent. heavier than avoirdupois, or 100 lbs. are equal to 108$\frac{4}{5}$ lbs. avoirdupois.

Trone Weight. This weight was abolished by act in 1618. Its name is still retained for selling butter, cheese, tallow, wool, lint, hemp, hay, and some other home commodities; but the trone stone and pound are generally denominated by avoirdupois pounds and

ounces. The trone pound always contains the same number of ounces avoirdupois, as the stone contains pounds. The weight of the stone, however, is very variable, and the avoirdupois weight of the same will, therefore, be stated under the different places.

LIQUID MEASURE.

4 Gills ..... = ...1 Mutchkin.
2 Mutchkins .....1 Chopin.
2 Chopins .....1 Standard Pint.
2 Pints .....1 Quart.
4 Quarts .....1 Gallon.
8 Gallons .....1 Barrel.

The Stirling pint jug is the unit of both the liquid and dry measures of Scotland. It contains 103,404 English cubic inches. Wine and spirituous liquors are now in general bought and sold in Scotland by English wine measures.

DRY MEASURE.

4 Lippies..... = ...1 Peck.
4 Pecks .....1 Firlot.
4 Firlots .....1 Boll.
16 Bolls .....1 Chalder.

The standard firlot for measuring wheat, pease, beans, rye, and white salt, contains 2197,333 English cubic inches—and the boll

for the same purpose contains, therefore, 8789,34 cubic inches, or 100 bolls are equal to about 51 quarters, 1 bushel, Winchester measure.

The standard firlot for measuring barley, oats, and malt, contains 3205,524 English cubic inches, and the boll contains 12822 cubic inches, or 100 bolls are equal to about 74 quarters 4 bushels, Winchester measure.

N. B. When grain is shipped, the above boll for wheat, &c. is said to deliver 4 per cent. more than 4 Winchester bushels; according to which, 100 bolls should be equal to 52 quarters. And the above bolls for barley, &c. is said to be 2 per cent. larger than 6 Winchester bushels, and therefore 100 bolls should be equal to $76\frac{1}{2}$ quarters.

LINEAR MEASURE.

3 Feet.. = ..1 Ell .. = $37\frac{1}{5}$ English Inches.
6 Ells .....1 Fall, or Rood.
24 Ells .....1 Chain.
10 Chains ....1 Furlong.
8 Furlongs ..1 Mile = 5952 English Feet.

Hence, 30 Scotch ells = 31 English yards, and 80 Scotch miles = 91 English miles.

SQUARE MEASURE.

6 Square Scotch Feet..	=	..1 Square Ell.
36 Square Ells		.1 Square Fall.
40 Square Falls		.1 Square Rood.
4 Roods		1 Acre.

The Scotch acre contains 1 acre, 1 rood, $3\frac{1}{3}$ perches, English; and therefore 48 Scotch acres equal 61 English acres nearly.

Scottish standards of weights and measures are distributed among the oldest boroughs: thus the ell or elwand is kept at Edinburgh, the pint at Stirling, the pound at Lanark, and the firlot at Linlithgow; but accurate copies of these are kept in many other towns, besides standards of provincial or county weights and measures, of which the following is a statement.

PROVINCIAL
WEIGHTS AND MEASURES,

ALPHABETICALLY ARRANGED.

ABERDEENSHIRE.

Weights. *Avoirdupois*, for English goods and groceries, and salt butter in the shops. Also for flesh, butter, cheese, tallow, hog's lard, and wool, in wholesale, the stone of 28 lb.

Scotch Troy, for flesh, butter, cheese, tallow, hog's lard, and wool, in retail.

For meal, reckoning 8 stone to the boll.

For coals, reckoning 36 stone to the boll.

Dry Measure. The boll for wheat, rye, pease, beans, meal, and seeds, contains 10754 English cubic inches; and 100 bolls are equal to about 62 quarters 6 bushels, Winchester measure.

The boll for barley, oats, and malt, contains 14068 cubic inches; and 100 bolls are equal to about 81 quarters 7 bushels, Winchester measure.

ARGYLESHIRE.

Weights. *Avoirdupois*, for salt, iron, flour, and groceries.

Trone, for fish, flesh, butter, cheese, tallow, hay, and wool, reckoning 24 lb. avoirdupois to the stone.

Dry Measure. The boll for wheat, rye, pease, and beans, contains 10218 English cubic inches; and 100 bolls are equal to about 59 quarters 3 bushels, Winchester measure.

The boll for barley, oats, and malt, at Inverary, contains 13753 cubic inches; and 100 bolls are equal to about 80 quarters, Winchester measure.

AYRSHIRE.

Weights. Avoirdupois, for iron, flour, and all groceries.

Trone, for butter, cheese, butchers' meat, hay, and wool, the stone of 24 lbs. and the pound of 24 oz. avoirdupois.

Dry Measure. The boll for wheat, rye, pease, and beans, is said to be exactly 4 Winchester bushels; and the boll for barley, malt, and oats, to be an English quarter.

BANFFSHIRE.

Weights. Avoirdupois, for English goods and groceries.

Scotch Troy, for meal, 8 stone to the boll, for green hides and butchers' meat.

Trone, for hay, wool, butter, cheese, and

tallow, the stone containing 24 lbs. Scotch Troy.

Dry Measure. The boll for wheat, beans, pease, and white salt, contains 9265 English cubic inches; and 100 bolls are equal to about 53 quarters 7 bushels, Winchester measure. The boll for barley, oats, and malt, contains 13476 cubic inches; and 100 bolls are equal to about 78 quarters 3 bushels, Winchester measure.

BERWICKSHIRE.

Weights. The stone of 24 lbs. avoirdupois for wool; the pound of 18 oz. avoirdupois for butter and fish, and for all other goods, avoirdupois.

Dry Measure. The boll for all sorts of grain is exactly equal to 6 Winchester bushels; or 100 bolls are equal to 75 quarters.

BUTESHIRE AND ARRAN.

Weights. *Trone*, 24 lbs. avoirdupois to the stone, for beef, mutton, butter, cheese, tallow, raw hides, wool, hemp, hay, and straw.

Scotch Troy, for pork. For meal, the growth of Bute, 9 stone to the boll; for meal imported, 8 stone to the boll.

Dry Measure. The boll for the produce of wheat, pease, and beans, at the above places, contains 11512 English cubic inches; and 100

bolls are equal to about 67 quarters, Winchester measure.

The boll for barley, oats, and malt, contains 17268 cubic inches; and 100 bolls are equal to about 100 quarters 3 bushels, Winchester measure.

For grain imported, the standard measures are used.

DUMBARTONSHIRE.

Weights. *Avoirdupois*, for English goods and groceries.

Trone. Each stone consisting of 23 lbs. avoirdupois, or 16 lbs. of 23 oz. avoirdupois each, for butter, cheese, butchers' meat, fish, and Scotch lint.

Dry Measure. The boll for wheat, pease, beans, and meal, contains 10251 English cubic inches; and 100 bolls are equal to about 59 quarters 5 bushels, Winchester measure. The boll for barley, oats, and malt, contains 13668 cubic inches; and 100 bolls are equal to about 79 quarters 4 bushels, Winchester measure.

DUMFRIESSHIRE.

Weights. *Avoirdupois*, reckoning 16 lbs. to a stone, for butchers' meat, bale goods, and groceries.

Trone, reckoning 24 lbs. to the stone, for butter, cheese, tallow, wool, raw hides, bark, and hay.

Dry Measure. The Winchester bushel is generally used for all sorts of grain. The Carlisle bushel, used in Eskdale, is equal to 3 Winchester bushels.

EDINBURGHSHIRE,

As stated in page 92.

Dry Measure. The corn measure is the standard, as stated in page 93.

ELGIN AND FORRESSHIRE.

Weights. Avoirdupois, for English goods and groceries.

Scotch Troy, for butchers' meat, and Dutch goods; for meal, reckoning 9 stones to the boll.

Trone, reckoning 21 Scotch troy pounds to the stone, for wool, butter, cheese, lint of Scotch product, and hay.

Dry Measure. The boll for wheat, rye, pease, and beans, contains 9384 English cubic inches; and 100 bolls are equal to about 54 quarters 5 bushels, Winchester measure. The boll for barley contains 13496 cubic inches; and 100 bolls are equal to about 78 quarters 4 bushels, Winchester measure. The boll for oats contains 16870 cubic inches; and 100

bolls are equal to about 98 quarters 1 bushel, Winchester measure.

FIFESHIRE.

Weights. *Avoirdupois*, for English goods and groceries.

Scotch Troy, for butchers' meat, foreign flax and hemp, and Dutch goods.

Trone, reckoning 16 Scotch troy pounds to the stone, and 20 Scotch troy ounces to the pound, for Scotch wool, butter, cheese, hides, and other Scotch produce.

Dry Measure. The boll for wheat, pease, and beans, contains 9100 English cubic inches, being 3529 per cent. larger than the standard; and 100 bolls are equal to about 52 quarters, 7 bushels, Winchester measure. The boll for barley, oats, and malt, contains 13236 cubic inches, being 3225 per cent. larger than the standard; and 100 bolls are equal to about 77 quarters, Winchester measure.

FORFARSHIRE.

Weights. *Avoirdupois*, for English goods and groceries.

Scotch Troy, for meal, 8 stones to the boll; for coals, 70 stones to the boll, (at Arbroath); for Dutch goods, and goods from the Baltic.

Dry Measure. At Montrose, and Forfar

the boll for wheat, pease, and beans, contains 9100 English cubic inches; and 100 bolls are equal to about 53 quarters, Winchester measure.

At Brechin, and Dundee, the wheat boll contains 8893 cubic inches; and 100 bolls are equal to about 51 quarters, 6 bushels, Winchester measure.

At Arbroath, the wheat boll contains 9384 cubic inches; 100 bolls are equal to about 54 quarters, 5 bushels, Winchester measure. The boll for barley, oats, and malt, at Forfar, contains 13236 English cubic inches; and 100 bolls are equal to about 77 quarters, Winchester measure.

At Brechin, and Montrose, the boll for barley contains 13442 cubic inches; and 100 bolls are equal to about 78 quarters, 2 bushels, Winchester measure.

At Dundee, the boll for barley, &c. contains 13029 cubic inches; and 100 bolls are equal to about 75 quarters, 6 bushels, Winchester measure.

At Arbroath, the boll for barley, &c. contains 12926 cubic inches; and 100 bolls are equal to about 75 quarters, 2 bushels, Winchester measure.

HADDINGTONSHIRE.

Weights. *Avoirdupois*, for English goods and groceries.

Scotch Troy, for meal, and butchers' meat.

Trone, reckoning 20 lbs. Scotch troy to the stone, for home commodities.

Dry Measure. The standard measures for corn are used here for all grain; but it is said they are larger than the real standards, by about 3 per cent.

INVERNESSHIRE.

Weights. *Avoirdupois*, for groceries.

Scotch Troy, for meal, reckoning 9 stone to the boll.

Trone, for wool, butter, cheese, and butchers' meat, reckoning 24 lbs. avoirdupois to the stone.

Dry Measure. The boll for wheat, pease, beans, and rye, contains 10060 English cubic inches; and 100 bolls are equal to about 58 quarters, 4 bushels, Winchester measure.

The boll for barley and malt, contains 14077 cubic inches; and 100 bolls are equal to about 81 quarters, 7 bushels, Winchester measure.

N. B. When oats are sold to go out of the county, the bargain is said to express generally

4 firlots only to the boll; in which case, the measure is the same as for barley.

KINCARDINESHIRE.

Weights. *Avoirdupois*, for English goods; for salt, reckoning 17 stone of 16 lbs. each to the boll.

Trone, for wool, butter, cheese, and tallow.

Dry Measure. The boll for wheat, rye, and pease, contains 9927 English cubic inches; and 100 bolls are equal to about 57 quarters, 6 bushels, Winchester measure.

The boll for barley and oats, contains 13650 cubic inches; and 100 bolls are equal to about 79 quarters, 3 bushels, Winchester measure.

KINROSSSHIRE.

Weights. *Avoirdupois*, for groceries.

Scotch Troy, for butchers' meat, and meal.

Trone, for butter, cheese, wool, rough hides, and hay.

Dry Measure. The boll for wheat, pease, and beans, contains 9022 English cubic inches; and 100 bolls are equal to about 52 quarters, 4 bushels, Winchester measure.

The boll for barley, oats, and malt, contains 13210 cubic inches; and 100 bolls are equal to

about 76 quarters, 6 bushels, Winchester measure.

KIRCUDBRIGHT STEWARTRY.

Weights. Avoirdupois, for English goods and groceries.

Scotch Troy, for meal, reckoning 17½ lbs. avoirdupois to the stone.

Trone, reckoning 16 lbs. to the stone, for home commodities.

Dry Measure. The boll for wheat, rye, pease, and beans, contains 23654 English cubic inches; and 100 bolls are equal to about 137 quarters, 4 bushels, Winchester measure. The boll for barley, oats, and malt, contains 11 Winchester bushels.

LANARKSHIRE.

Weights. Avoirdupois, for English goods and groceries.

Trone, for butter, cheese, and wool, reckoning 22 lbs. avoirdupois to the stone.

Scotch Troy, for meal, butchers' meat, and iron.

Dry Measure. At Lanark and the Upper Ward of the county, the boll for wheat, pease, and beans, is standard, (see page 93.) but the boll for barley and oats, is 3225 per cent. more than standard, containing 13236 English

cubic inches; or 100 bolls are equal to about 77 quarters, Winchester measure.

At Glasgow, and the Lower Ward of Lanarkshire, the boll for wheat contains 9257 cubic inches; and 100 bolls are equal to about 53 quarters, 7 bushels, Winchester measure.

The boll for beans, and pease, contains 13085 cubic inches; and 100 bolls are equal to about 76 quarters, 1 bushel, Winchester measure. The boll for barley, and oats, contains 13358 cubic inches; and 100 bolls are equal to about 77 quarters, 5 bushels, Winchester measure.

LINLITHGOWSHIRE.

Weights. Avoirdupois, for tanned hides, dressed flax, combed wool, and groceries.

Scotch Troy, for iron, rough calf skins, undressed flax, and meal.

Trone, the stone of 22 lbs. avoirdupois, for wool, butter, cheese, rough hides, and tallow.

Dry Measure. The measure for all kinds of grain, is the standard measure, as stated in page 93.

NAIRNSHIRE.

Weights. Avoirdupois, for groceries, and foreign goods; for flour, reckoning 8 lbs. to each peck, of a boll of 16 pecks.

Scotch Troy, for beef, pork, hides, hemp, and flax.

Trone, for wool, butter, cheese, tallow, and other home commodities; the stone of 21 lbs. Scotch troy, and the pound of 21 troy ounces.

Dry Measure. The boll for wheat, pease, beans, rye, oat-meal, and barley-meal, contains 10721 English cubic inches; and 100 bolls are equal to about 62 quarters, 3 bushels, Winchester measure. The boll for barley, contains 14295 cubic inches; and 100 bolls are equal to about 83 quarters, 1 bushel, Winchester measure. The boll for oats, contains 17868 cubic inches; and 100 bolls are equal to about 103 quarters, 7 bushels, Winchester measure.

PEEBLESSHIRE.

Weights. Avoirdupois, for groceries.

Trone, the stone of 23 lbs. avoirdupois, for wool, cheese, butter, hay, coals, tallow, and hides.

Scotch Troy, for meal, barley, butchers' meat, and iron.

Dry Measure. The boll for wheat, pease, beans, and rye, contains 9418 English cubic inches; and 100 bolls are equal to about 54 quarters, 6 bushels, Winchester measure. The boll for barley, malt, and oats, contains 13394

cubic inches; and 100 bolls are equal to about 77 quarters, 7 bushels, Winchester measure.

PERTHSHIRE.

Weights. *Avoirdupois*, the stone of 16 lbs. for all merchant goods.

Scotch Troy, for butchers' meat, and undressed flax; for coals, reckoning 40 stones to the boll, and 16 bolls to the chalder.

Trone, the stone of 22 lbs. avoirdupois, for butter, cheese, and rough tallow.

Dry Measure. The boll for wheat, pease, beans, and rye, contains 9052 English cubic inches; and 100 bolls are equal to about 52 quarters, 5 bushels, Winchester measure. The boll for oats, barley, and malt, contains 13356 cubic inches; and 100 bolls are equal to about 77 quarters, 5 bushels, Winchester measure.

RENFREWSHIRE.

Weights. *Avoirdupois*, for English goods and groceries.

Scotch Troy, for meal, 8 stone to the boll; and for iron.

Trone, the stone of 21½ lbs. avoirdupois, for cheese, butter, and tallow.

Dry Measure. The boll for wheat is standard, as stated page 93.

The boll for beans, pease, and vetches, contains 9617 cubic inches; and 100 bolls are equal to about 56 quarters, Winchester measure. The boll for oats and beans contains 13623 cubic inches; and 100 bolls are equal to about 79 quarters, 2 bushels, Winchester measure.

N. B. Corn of all kinds is exported from Greenock, and Port Glasgow, by the Winchester bushel.

ROSS & CROMARTIESHIRE.

Weights. Avoirdupois, the stone of 16 lbs. for butchers' meat and groceries.

Scotch Troy for meal, reckoning 9 stone to the boll.

Trone, reckoning 21 lbs. Scotch troy to the stone, for butter, cheese, tallow, fish and flax.

Dry Measure. The boll for wheat, rye, pease, and beans, is standard, as stated in page 93.

The boll for oats, barley, and malt, contains 13236 cubic inches; and 100 bolls are equal to about 77 quarters, Winchester measure.

ROXBURGHSHIRE & TEVIOTDALE.

Weights. Avoirdupois, for groceries and English goods.

Scotch Troy for flesh, iron, meal, flour, and pot barley.

Trone, for wool, lint, butter, cheese, tallow, and raw hides, the stone of 24 lbs. avoirdupois.

Dry Measure. The boll for wheat, pease, and beans (of four firlots) contains 9200 cubic inches; and 100 bolls are equal to about 53 quarters, 4 bushels, Winchester measure. The boll for barley and malt (of 4 firlots) contains 13,650 cubic inches, and 100 bolls are equal to about 79 quarters, 3 bushels, Winchester measure.

At Kelso market, the boll for wheat, &c. contains 6 Winchester bushels; and the boll for barley, &c. contains $7\frac{1}{2}$ Winchester bushels.

SELKIRKSHIRE.

Weights. Avoirdupois for English goods and groceries.

Scotch Troy, reckoning 17 lbs. 8 oz. avoirdupois to the stone, for meal, barley, butchers' meat, and iron.

Trone, the stone of $23\frac{1}{2}$ lbs. avoirdupois, for wool, butter, cheese, raw hides, tallow and hay.

Dry Measure. The boll for wheat, rye, beans, and pease (of 4 firlots) contains 9225 English cubic inches; and 100 bolls are equal to about 53 quarters 5 bushels, Winchester measure. The boll for oats, barley, and malt, (of 4 firlots) contains 12925 cubic inches; and

100 bolls are equal to about 75 quarters 1 bushel, Winchester measure.

STIRLING & CLACKMANNANSHIRE.

Weights. *Avoirdupois*, for groceries, bread, dressed lint, and dressed wool.

Trone, the stone consisting of 22 lbs. 14¾ oz. avoirdupois, for wool, butter, cheese, feathers, rough hides, and tallow.

Dry Measure. The measures for grain in both counties are fixed to be standards; but many of the customary measures are said to be larger, viz. the boll for wheat, pease, beans, and rye, is said to contain 9513 English cubic inches, being 8,235 per cent. more than the standard; and 100 bolls are equal to about 55 quarters, 3 bushels, Winchester measure. The boll for barley, malt, and oats, is said to contain 13752 cubic inches, being 7,258 per cent. more than the standard; and 100 bolls are equal to about 55 quarters, 3 bushels, Winchester mea-measure. The boll for barley, malt, and oats, is said to contain 13752 cubic inches, being 7,258 per cent. more than the standard; and 100 bolls are equal to about 80 quarters, Winchester measure.

SUTHERLANDSHIRE.

Weights. *Avoirdupois*, for English goods and groceries.

Trone, the stone of 24 lbs. avoirdupois to the stone, for cheese, butter, tallow and wool.

Dry Measure. The boll for pease, rye, and beans, contains 10340 English cubic inches; 100 bolls are equal to about 60 quarters, 1 bushel, Winchester measure. The boll for oats, barley, and malt, is generally the same as in Invernessshire; 100 bolls being equal to about 81 quarters, 7 bushels, Winchester measure.

At Dornock, the boll for barley, &c. contains 14187 cubic inches; and 100 bolls are equal to about 82 quarters, 4 bushels, Winchester measure.

WIGTONSHIRE.

Weights. Avoirdupois, for butchers' meat, and English groceries.

Trone, the stone of $26\frac{1}{4}$ lbs. avoirdupois, for butter, cheese, and wool.

Scotch Troy, for meal, reckoning 16 stone to a boll.

Dry Measure. The boll for wheat, pease, and beans, contains 8 bushels; and the boll for oats, barley, and malt, contains 12 bushels, Winchester measure.

WEIGHTS & MEASURES

OF

IRELAND.

Before the establishment of English Government in Ireland, very little can be collected from ancient authors on the subject of weights and measures. Sir James Ware, in his elaborate work on the Antiquities of that country, has not ventured on the question. But his translator and able editor, Mr. Harris, has given a very interesting paper on the subject from which a few extracts are here made.

"I do not find," says that learned writer, "that the ancient Irish or the Britons, had the use of any fixed or certain measure of capacity in a commercial sense: so that (as far as I am informed) the terms, Pint, Quart, Pottle, &c. do not so much as occur in the ancient languages of either of those countries. The *Meader*, a vessel so called in Irish, and *Medr*, in British, was of no certain capacity, but larger or smaller according to the artificer's fancy, or the materials he had ready at hand for working upon. It was a can or pitcher four

cornered, and made of one piece of timber hollowed into angles with a chisel; the British, and the Scottish-Irish, made them round, and hooped them for strength. The *Cronnog* was a basket or hamper for holding corn, made of twigs, and lined with skins; of no certain dimensions, or perhaps it generally amounted to about the quantity of the Barrel of Bristol, brought into use in Ireland, since the English got footing there; from whence often occurs in history the term *Crannock*, for a barrel, corrupted, as may be supposed, from the Irish word *Cronnog*, aforesaid. The Bristol barrel is, for the most part, used through the kingdom. In Cork, the reputed barrel of barley, is three Bristol barrels, and in Limerick two. The *Hoggat* and the *Bow* are terms made use of for certain measures in the county of Down, and some other northern parts, and are equal to ten bushels, or two barrels and a half of the Bristol measure. The county of Wexford Dry Measure is distinguished from other measures in the Table to the Red Council Book, made in the reign of King Henry VIII, where it is said, 'That Kinsallough, held of the king's mannor of Ferns, by paying yearly twenty fat marts (or beeves) twenty good sheep, and twenty pecks of oats, of the county of Wexford measure.' But it is not specified there, what that

measure is. A *Quirren* is a term applied in some parts of Ireland to a measure of butter, and is judged to contain a pottle of four pounds. The Srone, a measure of oatmeal, so called, contained three pottles.

" The ancient Irish (continues Mr. Harris,) had no certain measure for an acre of land, and the same Spelman observes, of the Anglo-Saxons, and Germans: but, he adds, that among the ancient Britons, the acre contained more than the modern one, and the same may be affirmed of the acre of Ireland, if distinguished into the great and small acre; the former of which contained three of the modern acres, and in some places much more.

" The *pertica*, or perch, called also the virga, and in some places the rod, the pole, and the log, in the reign of King John, contained 20 feet in measure—afterwards, generally 16½ feet. Yet, by custom, the perch differs in several counties; consequently the acre is larger or less. For, let the perch be what it will, the acre consists of 8 score square perches."

Mr. Harris gives a curious account of large tracts of land, under different denominations, such as a knight's fee, hide, plow land, yard land, ox-gang, tuogh, cinament, with ballybetagh, and numerous other terms, which vary in

the number of acres, from 10 to 700. Sir John Davis says, in his letter to the Earl of Salisbury, 1606, "That in the county of Monaghan, a ballybetagh signifies a town, capable of maintaining hospitality. That it contains 16 taths, and every tath 60 English acres; and he reckons 100 ballybetaghs to be in the same county." *So far Mr. Harris.*

It appears that the introduction of English Weights and Measures into Ireland was coeval with the establishment of British law in that country. So early as the year, 1351, it was enacted in the English Parliament, that the same weights and measures should be used in Ireland, as were used in England; and by a statute of the 10th of Henry VII. called Poyning's law, all the enactments relating to the subject, which had been passed in England, became of force in Ireland. The following is nearly the present state of weights and measures there.

The most important difference between English and Irish Metrology is, in land and road measures. The inch, foot, and yard, are the same in both countries, but the Irish perch is 7 yards, and that of England only $5\frac{1}{2}$; hence 11 Irish miles equal 14 English miles, and $30\frac{1}{4}$ Irish acres equal 49 English acres. There is a small difference in the liquid measures; thus

the Irish wine gallon measures 217.6 cubic inches, and that of England 231. Hence 100 English gallons equal 106$\frac{1}{6}$ Irish gallons; dealers generally allow 6 per cent. for the difference.

Corn is sold by weight, under the common denomination of the barrel (probably from the ancient Bristol barrel before mentioned). It is generally estimated at 4 bushels, but the weight differs for different kinds of grain: thus, the barrel of wheat, pease, beans, and rye is 20 stone; the barrel of barley, bere, and rape seed, 16 stone, that of oats 14, or in some places 12 stone, and of malt 12 stone. The stone is 14 lb. avoirdupois.

There are some local customs varying from the above system, but weights and measures are notwithstanding, much more uniform in Ireland, than either in England or Scotland.

APPENDIX,

Containing a general View of the Principles and Provisions of a Bill intended to ascertain and establish Uniformity of Weights and Measures in England and Scotland.

THIS Appendix is intended to give a general view of the principles and provisions of a New Bill for establishing uniformity of Weights and Measures in England and Scotland, of which a full explanation may be collected from the following Report and Outlines. It may however be useful, briefly, to state the plan.

By this Bill, no alteration is to be made in weights, except that the avoirdupois pound is to be made the standard instead of the troy pound; the present wine, ale, and corn measures are to be abolished, and one only substituted in their place, which is to be ascertained by weight instead of gauging. This weight is derived from certain proportions of a cubic foot of water, which has been found to weigh 1,000 ounces avoirdupois, or $62\frac{1}{2}$ pounds, hence the gallon weighs 10 pounds = 276,48 cubic inches. Thus—

The Gallon of	10 lbs.	=	276,48 Cubic Inches
The Bushel = 8 Gallons	= 80 lbs.	=	2211,84 Cubic Inches
The Quart = $\frac{1}{4}$ Gallon	= 40 oz.	=	69,12 Cubic Inches
The Pint.. = $\frac{1}{8}$ Gallon	= 20 oz.	=	34,56 Cubic Inches
The $\frac{1}{2}$ Pint = $\frac{1}{16}$ Gallon	= 10 oz.	=	17,28 Cubic In. or $\frac{1}{100}$ of a Foot

APPENDIX,

Containing the Report of the Select Committee of the House of Commons on Weights and Measures—1814:—*with the Outlines of the New Bill, &c.*

"THE Select Committee appointed to enquire into the original Standards of Weights and Measures in this Kingdom, and to consider the Laws relating thereto; and to report their Observations thereupon, together with their Opinion of the most effectual Means for ascertaining and enforcing uniform and certain Standards of Weights and Measures to be used for the future; and to whom were referred the Reports which, upon the 26th day of May, 1758, and the 11th day of April, 1759, were made from the Committee appointed to enquire into the original Standards of Weights and Measures in this Kingdom, and to consider the Laws relating thereto; and also the Standard Weights and Measures referred to in the said Reports; have examined the Matters to them referred, and agreed upon the following Report:

Your Committee, in the first place, proceeded to enquire what measures had been taken to establish uniform weights and measures throughout the kingdom. They found that this subject had engaged the attention of Parliament at a very early period. The Statute Book from the time of Henry the Third abounds with Acts of Parliament enacting and declaring that there should be one uniform weight and measure throughout the

realm; and every act complains that the preceding statutes had been ineffectual, and that the laws were disobeyed.

The Select Committee of the House of Commons, which was appointed in the year 1758, to enquire into the original standards of weights and measures in this kingdom, and to consider the laws relating thereto, made a very elaborate report on this subject, in which is contained all the information that is necessary with regard to the enquiry into what were the original standards of weights and measures: such parts of that report as have appeared to your Committee to be most important, are inserted in the appendix to this report.

The Committee of 1758 first give an abridged state of the several statutes which have been enacted relating to weights and measures, 1st. so far as they establish any weights or measures, or standards for the same; and 2d. so far as any means, checks, or sanctions are provided to compel the use of the established weights and measures, or to punish disobedience. The Committee then point out what appeared to them to be the principal causes which had prevented the attainment of that uniformity, so much and so wisely desired by Parliament. These are stated to be the want of skill in the artificers, who from time to time made copies of the standards kept in the Exchequer; and as these imperfect measures were again copied from, every error was multiplied, till the variety of standards rendered it difficult to know what was the real standard, or to apply any adequate remedy.

In the second place, the multiplicity of statutes made on this subject, many of which are at variance with one another, and in many of which there are partial excep-

tions of particular counties, and particular articles, from the operation of the acts, appeared to the Committee to be the principal cause of the various errors which were every where found to prevail.

Upon an accurate comparison of the various measures preserved in the Exchequer, and which are directed to be used for sizing and adjusting all other measures, they were found to differ materially from each other, and yet (the Committee observe) as the law now stands, all these measures must be understood to contain the like quantities, are equally legal, and may be indiscriminately used.

Of these various measures, the Committee recommend the adoption of the ale gallon of 282 cubical inches, and to abolish the use of all the others. They also recommend that the troy pound should be the only standard of weight. Though your Committee agree entirely with the Report of the Committee of 1758, that there should be only one gallon for measuring all articles whatsoever, and only one denomination of weight, yet they cannot concur, for reasons which will be hereafter stated, in the selection made by that Committee in appointing these standards.

This Report was agreed to by the House, and in the year 1765, two bills were brought in by Lord Carysfort, who was Chairman of the Committee of 1758, for the purpose of carrying into effect the resolutions of that Committee. These bills were severally read a first and second time, and committed; and the bills, as amended by the Committee, were ordered to be printed on the 8th day of May. Parliament was, however, prorogued in that year on the 25th day of May; and these Bills, which (as far as can be collected from the Jour-

nals,) were approved of by the House, were thus unfortunately lost.

Since that period, little has been done to accomplish this important object. A Committee was indeed appointed in the year 1790, but they do not appear to have made any progress, as your Committee have been unable to find any minutes of their proceedings.

Two Acts were passed in the years 1795 and 1797, the 35 Geo. III. cap. 102, and 37 Geo. III. cap. 143, which empower Justices of the Peace to search for and destroy false weights, and to punish the persons in whose possession they are found; but no mention is made in these acts of deficient measures.

Your Committee now proceed to state what appear to them to be the principal causes which have prevented the establishment of uniform weights and measures; and to state the reasons which have induced them to differ from the Committee of 1758, in some of their resolutions.

It appears to your Committee, that the great causes of the inaccuracies which have prevailed, are the want of a fixed standard in nature, with which the standards of measure might at all times be easily compared, the want of a simple mode of connecting the measures of length with those of capacity and weight, and also the want of proper tables of equalization, by means of which the old measures might have readily been converted into the new standards. Some rude attempts seem to have been made to establish a mode of connecting the measures of capacity with weight. In an act of the 51st of Henry Third, intituled "Assisa Panis et Cervisiæ," it is declared "that an English penny, called "the sterling, round without clipping, should weigh 32

"grains of wheat, well dried and gathered out of the "middle of the ear; and 20 pence to make an ounce, "12 ounces a pound, 8 pounds a gallon of wine, and "8 gallons of wine a bushel of London."

Nothing, however, can be more uncertain and inaccurate than this method of determining the size of a gallon measure by the weight of a certain number of grains of wheat, which must vary according to the season and the nature of the soil and climate where they are produced.

In order to obtain some information as to what were the best means of comparing the standards of length, with some invariable natural standard, your Committee proceeded to examine Dr. W. Hyde Wollaston, secretary to the Royal Society, and Professor Playfair of Edinburgh.

From the evidence of these gentlemen, it appears that the length of a pendulum making a certain number of vibrations in a given portion of time, will always be the same in the same latitude; and that the standard English yard has been accurately compared with the length of the pendulum which vibrates 60 times in a minute in the latitude of London.

The length of this pendulum is 39.13047 inches, of which the yard contains 36. Any expert watch-maker can easily adjust a pendulum, which shall vibrate exactly 60 times in a minute.

The French government have adopted as the standard of their measures, a portion of an arc of the meridian, which was accurately measured. The standard metre, which is the 10,000,000th part of the quadrant of the meridian, which is engraved on the Platina scale

preserved in the National institute, has been compared with the English Standard Yard, by professor Pictet of Geneva, and was found to exceed it, at the temperature of 32 degrees, by 3.3702 inches: and at the temperature of 55 degrees, by 3.3828 inches.

The Standard Yard may therefore be at any time ascertained, by a comparison either with an arc of the meridian, or the length of the pendulum, both of which may be considered as invariable.

The Standard of Linear Measure being thus established and ascertained, the Measures of Capacity are easily deduced from it, by determining the number of cubical inches which they should contain. The Standard of Weight must be derived from the Measures of Capacity, by ascertaining the weight of a given bulk of some substance of which the specific gravity is invariable. Fortunately that substance which is most generally diffused over the world answers this condition. The specific gravity of pure water has been found to be invariable at the same temperature; and by a very remarkable coincidence, a cubic foot of pure water (or 1,728 cubical inches) at the temperature of 56½° by Fahrenheit's thermometer, has been ascertained to weigh exactly 1000 ounces avoirdupois, and therefore the weight of 27,648 inches is equal to one pound avoirdupois.

This circumstance forms the groundwork of all the succeeding observations of your Committee.

Although in theory the Standard of Weight is derived from the Measures of Capacity, yet in practice it will be found more convenient to reverse this order.

The weight of water contained by any vessel, affords the best measure of its capacity, and is more easily ascertained than the number of cubical inches by gauging.

Your Committee therefore recommend that the Measures of Capacity should be ascertained by the weight of pure or distilled water contained by them, rather than by the number of cubical inches, as recommended in the 4th resolution of the Committee of 1758.

Your Committee are also of opinion, that the Standard Gallon, from which all the other Measures of Capacity should be derived, should be made of such a size as to contain such a weight of pure water of the temperature of $56\frac{1}{2}°$, as should be expressed in a whole number of pounds avoirdupois, and such also as would admit of the quart and pint containing integer numbers of ounces, without any fractional parts.

If the gallon is made to contain 10 pounds of water, the quart will contain 40 ounces, and the pint 20.

This gallon recommended by your Committee, will contain 276.48 cubical inches, being nearly 3 per cent. larger than the gallon or 8th part of the Winchester Bushel as fixed by the Act of the 13th and 14th of William and Mary, cap 5, which contains 268.803 cubical inches, and the bushel will contain 2211.84 cubical inches, instead of 2150.42.

Your Committee are of opinion, that this departure from the Corn Measure, which is employed in the collection of the Malt Tax, and is supposed to be most generally used throughout the kingdom, is justified by the advantages which they anticipate from the change.

General uniformity cannot be expected, unless some simple and accurate method of checking the Standard Measures is adopted; and as the weight of water ap-

pears to be the best and most simple method of checking Measures of Capacity, it is desirable that all minute fractions of weight should be avoided. There will be much less chance of error in weighing the water contained in any measure, if only one or two weights are to be employed, than if a greater number were necessary, which would be the case if fractional parts were required.

The difficulty of remembering long fractions is also an important consideration, and would very materially impede the attainment of that general uniformity which is so much desired.

If this gallon is adopted, the bushel will contain 80lb. of water, or 2211.84 cubical inches; the quart 69.12 cubical inches, or 40 ounces of water: the pint 34.56 cubical inches, or 20 ounces of water: the half-pint will contain 17.28 cubical inches (which is exactly $\frac{1}{100}$th part of a cubical foot), and 10 ounces of water. Any smaller measures might with great propriety be described, according to the number of ounces of water they contained.

Your Committee are of opinion, that the simple connection which will in this manner be established between the Standard of Weight and Measures of Capacity, will greatly tend to preserve the uniformity of those Measures which are found to be most liable to error.

They have, besides, been induced to select this size of Measure as a Standard, both because it very nearly coincides with one of the Standard Corn Measures preserved in the Exchequer, namely, the Standard Pint marked 1602, which contains 34.8 cubical inches; and also because it possesses the advantage of bearing very simple relations to the Gallon Measures, which are

employed in measuring ale and wine. The calculations therefore which would be necessary for ascertaining the corresponding duties, which must be charged upon exciseable liquors, would be easily made.

The proportions between the proposed gallon and the measures now in use will be found in the appendix.

Your Committee will now proceed to state their opinion with regard to the Standard of Weight. Although the troy pound is the only weight established by law, yet the avoirdupois pound is so much more generally known and used, that your Committee cannot hesitate to recommend it in preference to the troy pound. Your Committee are however inclined to recommend two exceptions: as the goldsmiths regulate their traffic by the troy weight; and considering the connection of this branch of trade with the standard of the coin, it appears advisable that gold and silver should be sold by troy weight.

Your Committee would also recommend that the apothecaries weight should remain without any alteration, as any change in the weights employed by them in compounding their medicines, might be attended with dangerous consequences.

It appears to your Committee that the most accurate mode of ascertaining the standard pound, is to immerse in water a solid cylinder of brass containing 27,648 cubical inches, and to ascertain the difference between its weight in water and its weight in air, by means of the common hydrostatic balance. The difference between its weight in water and its weight in air, (or the weight of the volume of water occupying the same space) is the pound avoirdupois.

This method is recommended, as it has been found to be much more easy to ascertain the solid contents of

any body, by taking its external dimensions, than to find the exact contents of any measure by gauging.

In this manner the Standard of Length is kept invariable, by means of the pendulum; the Standard of Weight, by the Standard of Length; and the Standard of Capacity, by that of Weight.

Your Committee have not gone into any detail of the inaccuracies of the present system, as they are very fully stated in the Report of the Committee of 1758, before alluded to.

In order to preserve uniformity in the Weights and Measures to be used in future, your Committee would recommend that no person be allowed to make or sell any Weights or Measures without having obtained a license for that purpose, on payment of a certain sum; and that all Weights and Measures should be marked with the name of the maker, and the initials of the person who examines them. The person who last examines the Weights and Measures, should not be permitted to alter them; but if he finds them to be incorrect, should return them to the maker, to be properly sized and adjusted. All new Weights and Measures will therefore in this manner undergo a double examination. Your Committee are of opinion, that the powers given to Justices of the Peace by the Acts of 35 Geo. III. cap. 102, and 37 Geo. III. cap. 143, to search for and destroy deficient Weights, and to punish the persons in whose possession they are found, should be extended, so as to give them the said powers with regard to false or deficient Measures.

Your Committee cannot conclude without stating the opinion of Professor Playfair, with regard to the necessity of adhering strictly to one simple and general view,

in appointing the standards, without departing from it, for the sake of accommodating individuals, or particular classes of the community. The advantage of the public at large cannot be consulted, unless this rule is rigorously observed. The simplicity and accuracy of the system would be sacrificed by any partial exceptions, and it may be considered as certain, that unless the rules are simple, and the constructions independent of minuteness of division, an opening will be left for fraud, and for all the perplexity in which the standards of the country are at this moment involved.

1. *Resolved*, That it is the opinion of this Committee, that it is necessary, in order effectually to ascertain and enforce uniform Weights and Measures to be used for the future, that all former Statutes relating thereto should be repealed.

2. That it is the opinion of this Committee, that the distance between the two points in the gold studs in the brass rod, described in the Report of the Select Committee of 1758, and preserved in the custody of the Clerk of this House, ought to be the length called a yard; and that one third part thereof should be a foot and the 12th part of the foot one inch.

3. That it is the opinion of this Committee, that the length of a pendulum vibrating 60 times in a minute of time, in the latitude of London, has been ascertained to be 39.13047 inches, of which the standand yard contains 36.

4. That it is the opinion of this Committee, that all measures of length whatsoever should be taken in parts multiples, or certain proportions of the said standard yard.

5. That it is the opinion of this Committee, that a cubic foot of pure water, at the temperature of 56½

degrees, has been ascertained to weigh exactly 1,000 ounces avoirdupois.

6. That it is the opinion of this Committee, that all measures of capacity should be ascertained by the weight of water therein contained, as well as by the number of cubical inches.

7. That it is the opinion of this Committee, that all measures of the same denomination, whether of liquids or of dry goods, ought to contain the same weight of water, and the same number of cubical inches.

8. That it is the opinion of this Committee, that the gallon ought to contain 10 pounds of pure water, or 276.48 cubical inches; that the quart, or 4th part of the gallon, ought to contain 40 ounces of water, or 69.12 cubical inches; that the pint, or half of the quart, ought to contain 20 ounces of water, or 34.56 cubical inches.

9. That it is the opinion of this Committee, that the bushel ought to contain 8 of the said gallons, or 80lbs. of water, or 2211.84 cubical inches; and that all other measures of capacity ought to be taken in parts, multiples, or proportional parts of the said gallon.

10. That is the opinion of this Committee, that the standard of Weight ought to be the pound avoirdupois, which is equal to the weight of 27.648 cubical inches of pure water, of the temperature of $56\frac{1}{2}°$; that the 16th part of the said pound should be an ounce, and the 16th part of such ounce should be a dram; that the third part of a dram should be a scruple, and the 10th part of the scruple one grain; and that all other Weights should be taken from parts, multiples, or proportional parts of this pound.

11. That it is the opinion of this Committee, that all

contracts, bargains, sales, and dealings ought to be taken and adjudged to be according to the standards aforesaid, and that no person should recover the price of goods sold, or the goods themselves, or any damages on account of any contracts, bargains, sales or dealings, but according to the said standards.

12. That it is the opinion of this Committee, that it ought to be penal for any person to have in his possession any Measure or Weight that is not agreeable to the aforesaid standard.

13. That it is the opinion of this Committee, that it ought to be made highly penal for any person to make or sell any Measure or Weight that is not agreeable to the aforesaid standards.

14. That it is the opinion of this Committee, that for enforcing an uniformity in the Weights and Measures to be used for the future, no person should be permitted to make Weights and Measures, without having first obtained a proper license for that purpose, on payment of a certain sum.

15. That it is the opinion of this Committee, that all Weights and Measures to be hereafter made, ought to be marked with the name of the maker; and, after a proper examination of the Weight or Measure, the same to be stamped with the initials of the name of the person who has examined it.

16. That it is the opinion of this Committee, that all Weights exceeding five pounds, should be made of brass, copper, bell metal, or cast iron; and that all weights of five pounds, or under, should be of gold, silver, brass, copper or bell metal.

17. That it is the opinion of this Committee, that the standard yard, mentioned in the 2d Resolution, and a

pound avoirdupois, made according to the directions before mentioned in this Report, together with models or patterns of the measures of capacity before mentioned, ought to be deposited in the Court of the Receipt of the Exchequer, and there safely kept under the seals of the Chancellor of the Exchequer, and of the Chief Baron, and the seal of office of the Chamberlains of the Exchequer, and not to be opened but by the order of the Chancellor of the Exchequer, and Chief Baron for the time being.

18. That it is the opinion of this Committee, that models or patterns of the said standard yard, gallon, and pound avoirdupois, and of the parts and multiples thereof, before mentioned, should be distributed in each county, city, or corporate town, being a county within itself, in such a manner as to be readily used as evidence, in all cases where Measures and Weights shall be questioned before the Justices of the Peace for each county, or city, and for adjusting the same in a proper manner.

19. That it is the opinion of this Committee, that the provisions of the Acts of the 35 Geo. III. cap. 102, and the 37 Geo. III. cap. 143, should be extended, so as to empower Justices of the Peace to search for and destroy false Measures as well as false Weights, and to hear and determine and put in execution, the law with regard to Weights and Measures, and to inflict or mitigate such penalties as shall be thought proper, and to have such other authorities as shall be necessary for compelling the use of Weights and Measures agreeable to the aforesaid standards.

20. That it is the opinion of this Committee, that the Sheriff of each county ought to be directed to summon a jury of 12 sufficient men, living within the county, to

return a verdict, on the comparison to be made before them of the proportions which the new standards bear to those formerly in use in each county respectively; and according to the verdict then returned, tables of equalization should be made, and copies of the same should be distributed through each county; and that all existing contracts or rents payable in corn, "should be calculated according to these tables of equalization."*

* The foregoing Report of the Committee contains nearly the substance of the principles and provisions of the Bill which has passed the House of Commons, and is now before the Lords. It is further explained and illustrated by the following statement, given by Dr. William Hyde Woollaston, at the conclusion of his examination before the Select Committee of the House of Commons, Sir George Clerk, Baronet, in the chair.

If the gallon measure be defined to be that which contains 10 lb. of water,

Then since the cubic foot of water weighs 1,000 oz.

$\frac{1}{2}$ Pint = 10 oz. = $\frac{1}{100}$ of cubic foot = 17.28 inches.
Pint.. = 20 oz. = 34.56.
Bushel = 80 lb. = 2211.84.

And the simple proportions above alluded to, will be found as follows:

	Cubical Inches.	
The Gallon of 10 lb. =	276.48 × $\frac{10}{98}$ = 282.01	282 Beer Gallon.
Also..... —— =	276.48 × $\frac{10}{12}$ = 230.40	231 Wine Gallon.
The Pint of $1\frac{1}{2}$ lb. =	34.56 × 3 = 103.68	103.40 Stirling Jug.
Bushel of....80 lb. =	2211.84 × $\frac{35}{36}$ = 2150.40	2150.42 Winch^{r} Bush.
A Cylinder of $18\frac{1}{2}$ diam.....	× 8 = 2208.93	Approximate Bushel.
Ditto ..... $18\frac{1}{4}$ ——	× 8.0105	2211.84 New Bushel.

OUTLINES

OF THE NEW BILL.

The following is the Substance of the principal Clauses contained in the proposed Bill.

1. The operations of the Bill to commence on the 1st January, 1818.

2. Copies and models of the standards to be made and verified; and within six calendar months after passing this Act, to be deposited in the office of the Chamberlains at Westminster.

3. Standards, if lost, destroyed, or injured, to be restored, and committed to the same custody to which the original standards were committed.

4. Makers, &c. of weights and measures, to be licensed. Every such license to continue, and be in force, for the space of 1 year, from the time of granting thereof, and no longer; for each of which, five shillings shall be paid, and no more; and all such weights and measures shall be marked with the name or initials of such persons, making or selling the same.

5. All weights, exceeding five pounds, shall be made of brass, bell-metal, or iron; and all of five pounds or under, shall be made of gold, silver, platina, brass, copper, or bell-metal.

6. Models and copies to be provided by counties. That His Majesty's Justices of the Peace shall, within one year after passing this Act, purchase for their respective counties or jurisdictions, a copy or copies of each of the weights and measures, and of each of the parts and

multiples thereof, which shall then be compared and verified with the copies at the Exchequer, on paying the usual fees, &c.

12. Weights and measures verified, and compared with verified models, held good.

13. Expense of procuring models and copies shall be assessed by the Commissioners of Supply, and shall be paid along with the land tax; the Collectors of which shall have a like power to levy the same, as they have for levying the land tax.

14. Weights and measures to be verified, and if found correct shall be duly marked; but if otherwise, the incorrectness shall be specified by the Examiner, and a certain rate shall be paid for the trouble and expense of examining and marking, to the person who has the custody of the models.

15. Privileges of the Corporation of London for sizing and sealing weights and measures not to be affected.

16. Privileges of the Dean and Chapter of Westminster for sizing, &c. not to be affected.

17. Rights of the Founders' Company not to be affected.

18. The method of ascertaining measures of capacity where reference cannot be had to standards is by impowering Magistrates to size and seal gallons that contain 10 lbs. weight of pure rain water, of the aforesaid temperature.

19. All bargains not made according to the legal standards to be null and void.

20. Exceptions—the Apothecaries and Goldsmiths continue their proper weights respectively, as heretofore.

21 The things for which heaped measure may be used, are coals, culm, lime, fish, and fruit; but corn, seeds, and any other dry goods, shall not be heaped, but shall be striked with a round stick, or roller, straight, and of the same diameter from one end to the other.

22. Steelyards for weighing carriages or commodities of 1 cwt. and upwards.

23. The mode of ascertaining rents, &c. payable in grain or malt in England is, that at the general quarter sessions of each place, an inquisition shall be taken before the Justices assembled, by the oaths of twelve substantial freeholders, who have lands or tenements to the value of £100 per annum and upwards; who are to ascertain the amount, according to the several standards established by this act, and such valuation shall be transmitted to his Majesty's Court of Exchequer at Westminster, there to be enrolled; and the amount so ascertained, shall be the rule of payment in future: and the expenses of such inquisition shall be paid out of the general stock of such county, &c.

24. The mode of ascertaining rents payable in grain or malt in Scotland is, that the Sheriff, Depute or Substitute in each shire, shall impannel a Jury with the same qualifications which are required in the Jury who strike the fiar prices of grain within the same shire or stewartry, who shall ascertain the amount according to the standards, by this law established, and such inquisitions when taken shall be transmitted by the Sheriffs' Clerks into his Majesty's Court of Exchequer at Edinburgh, and shall be there inrolled of record, and may be given in evidence in any action at law, and the amount so ascertained and converted into the new

standards, shall be the rule of payment, and the charges of such shall be defrayed by every such shire or stewartry.

25. Tables of equalization to be made under the authority of the Lord High Treasurer of Great Britain, shewing the proportion between the weights and measures formerly in use, and those recently established, and future payments to be regulated according to such tables.

26. Tables of the foregoing description to be constructed under the same authority for the collection of the customs and excise.

27. Prices at which corn shall be permitted to be imported, under the 55th Geo. III. chap. 26, to be calculated in proportion to the difference of measure, as set forth in the tables of equalization before mentioned.

28. The penalties on using weights and measures not marked, or making weights and measures without a licence, are, for every such offence, £10 sterling. The penalty on counterfeiting marks is transportation for seven years, as if guilty of felony.

29. Former standards, and weights and measures to be destroyed after the 1st of January, 1818.

30. Examiners of weights and measures are to be appointed by Magistrates, and shall be empowered to enter in the day time any house, shop, or dwelling, and there to examine all weights and measures of capacity and balances; to destroy such as are found erroneous, and to fine the person so offending in a sum of money not exceeding 20s. nor less than 5s.; and any person obstructing such examiners shall forfeit for each offence a sum not exceeding £5 nor less than 40s. The

Examiners are to be allowed a reasonable recompense for their trouble, to be paid out of the general stock of each county, riding, &c. in England, or out of the rogue-money of any shire, &c. in Scotland.

31. Forfeitures are to be recovered in England by bill, plaint, or information, in any of his Majesty's Courts of Record, or by any two or more Justices of the Peace; and appeals are to be made at the quarter sessions.

32. Forfeitures are to be recovered in Scotland by an appeal to Sheriffs, Stewarts, or Magistrates; and appeals to be made at the Circuit Court of the High Court of Justiciary.

33. Forfeitures to be applied as in similar cases, one-half to the person suing for the same, and the other half to the Treasurer of the county, &c. Persons fined not to be otherwise punishable, and no action or prosecution to be received or sustained, unless the same be brought within six calendar months after the alleged offence.

All former Acts not agreeing with the provisions of this Bill to be repealed.

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